CANADA FOUNDATION FOR INNOVATION

SCIENCE AND ENGINEERING RESEARCH CANADA

CANADIAN INSTITUTES OF HEALTH RESEARCH

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NETWORKS OF CENTRES OF EXCELLENCE

CANADA RESEARCH CHAIRS

ONTARIO INNOVATION TRUST

ONTARIO RESEARCH AND DEVELOPMENT CHALLENGE FUND

PREMIER'S RESEARCH EXCELLENCE AWARDS

ONTARIO CENTRES OF EXCELLENCE

A Sampling of 2004-05

Success Stories

of

Federal and Provincial Investment in University Research

PREPARED BY THE ONTARIO COUNCIL ON UNIVERSITY RESEARCH

ISBN: 0-88799-401-6
COU No: 767

105-05950/

Research Success Stories

June 2005

Dear Colleague:

The Ontario Council on University Research is pleased to present the fourth edition of *Research Success Stories*.

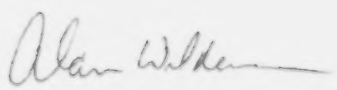
Each publicly assisted university has contributed stories that profile the important research being conducted by faculty, staff, and graduate and undergraduate students on Ontario's campuses. Several stories demonstrate the crucial connection between excellence in research and excellence in teaching—the hallmark of university education in Ontario.

The research projects described here were made possible by the research funding programs of the federal and provincial governments, and by funding from agencies, foundations, and private sector partners. The array of funding sources for these projects is indicative of the important contribution that university research makes to the health and quality of life of Ontarians, to our social and cultural development, and to Ontario's and Canada's economic competitiveness.

A brief description follows of the major federal and provincial programs that have contributed to the leading edge research described in these stories, and each story includes a funding profile that lists all major contributors. Ontario universities are grateful for the funding that has allowed our researchers to demonstrate their commitment to discovery, innovation, and the advancement of knowledge.

I hope you will enjoy these stories that celebrate the important contribution of university research and the dedication and achievements of our researchers.

Yours sincerely,



Alan Wildeman, PhD
Chair, Ontario Council on University Research
Vice-President (Research), University of Guelph

Key Federal and Provincial Research Funding Programs

In addition to the programs of three federal research granting councils—Science and Engineering Research Canada (NSERC), the Canadian Institutes of Health Research (CIHR), and the Social Sciences and Humanities Research Council (SSHRC)—federal programs frequently cited in Success Stories include:

Canada Foundation for Innovation (CFI): Established in 1997, the CFI provides support on a competitive basis for the development of research infrastructure at universities, hospitals, research institutes, and colleges. The CFI supports 40% of project costs and recipients must raise the remaining 60% from other sources, including provincial programs and the private sector. For Ontario projects, the Ontario Innovation Trust matches the CFI contribution for projects funded prior to June 2004. Infrastructure projects funded after June 2004 were awarded matching funds from the Ontario Research Fund.
Website: *www.innovation.ca*

Canada Research Chairs (CRC) Program: This program was introduced in 2000 to support the establishment of 2,000 Chairs in Canadian universities by 2005. Tier I Chairs are awarded to experienced star researchers who will receive $200,000 annually for seven years, renewable for any number of terms. Tier II Chairs are awarded to exceptional emerging researchers, who will receive $100,000 annually for five years, renewable once.
Website: *www.chairs.gc.ca*

Networks of Centres of Excellence (NCE) Program: NCEs, which are funded through the budgets of the three federal granting councils, foster research partnerships among universities, industry, and government to develop the economy and improve the quality of life of Canadians. Currently, there are 21 networks, nine of them led by Ontario institutions.
Website: *www.nce.gc.ca*

Ontario Government programs often cited in the stories include:

Ontario Research and Development Challenge Fund (ORDCF): The ORDCF was established in 1997 to competitively select and support leading-edge research initiatives of interest to the private sector. Initially, the ORDCF contributed one-third of total project costs, and private sector partner(s) and the university each contributed one-third of the total. Currently, the ORDCF supports 22% of total project costs while the university contributes 44%. The private sector partners still contribute at least one-third.
Website: *www.ontariochallengefund.com*

Ontario Innovation Trust (OIT): The OIT was established in 1999 to fund research infrastructure projects of importance to the province. It is the main vehicle for matching the CFI's contribution to Ontario projects, generally supporting 40% of project costs. Thus, for projects supported by the CFI and OIT, Ontario universities must raise 20% of project costs from other sources.
Website: *www.oit.on.ca*

Premier's Research Excellence Awards (PREA): The PREAs provide support for promising young researchers to hire graduate students and post-doctoral students for their research programs. Recipients are selected competitively and usually are awarded about $150,000. Two-thirds of this funding, or up to $100,000, is provided by the Ontario government, while the university provides the remaining $50,000 through funds raised from the private sector.
Website: *http://www.ontariocanada.com/ontcan/en/rts/rts_prea.jsp*

Ontario Centres of Excellence (OCE) Program: This program was established in 1987 to train researchers and to bridge the gap between industry and university research by bringing research discoveries to the marketplace in the form of new products and services. Currently there are five divisions that focus on key areas of technology: materials and manufacturing, communications and information technology, earth and environmental sciences, photonics, and alternative energy. The Ontario government provides total annual funding of $34.3 million.
Website: *www.oce-ontario.org/*

Ontario Research Fund (ORF): This program was established in 2004 to provide Ontario's research community with one window for both operating and infrastructure research funding. Starting in 2004, the ORF has replaced funding previously provided through the Ontario Innovation Trust, the Ontario Research and Development Challenge Fund and the Ontario Research Performance Fund.

Research Talent Development (RTD) Program: This program was established to support early career researchers with recognized potential. Starting in 2005, RTD replaces funding previously awarded through the Premier's Research Excellence Awards.

Ontario universities also acknowledge the contribution of the federal Indirect Costs program and the Ontario Research Performance Fund to the indirect costs of the research supported by these programs.

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Brock University

Tracking Disease Migration

Dr. Ana Sanchez, Assistant Professor in the Department of Community Health Sciences, focuses her research on parasitic diseases in developing countries. Specifically, she has been studying Taenia Solium, a parasitic tapeworm that causes neurological damage, such as epilepsy and related diseases, primarily in people living in Latin America, Asia and Africa. However, Dr. Sanchez explains, "This parasite can also affect people in developed nations because it migrates with increasing frequency to and from endemic countries."

Dr. Sanchez feels that although this parasite is rare in Canada, researchers should not be deterred from looking at the impact it might have here. Currently, she is documenting infection rates in this country and the impact these rates might have on the economy as well as the health of Canadians who have contracted the parasite.

This parasitic tapeworm contaminates pork meat in developing countries, resulting in not only a serious public health risk for the region but also considerable economic loss. Motivated by this reality, Dr. Sanchez is researching the socio-economic impact of infection on people living in Honduras. At the same time, she is spearheading a public health campaign aimed at controlling the transmission of the parasite.

Dr. Sanchez's work has allowed Brock researchers to forge ongoing collaborations with scientists in Honduras. "Tracking and studying parasitic diseases is important to all nations," cautions Dr. Sanchez. "Parasites found mainly in underdeveloped nations can no longer be seen as merely a local health issue."

It is very important to conduct research in collaboration with developing nations because Canadians who travel internationally frequently contract diseases foreign to their home country. These diseases may enter the local population undetected due to the infrequency of diagnosis or the inexperience of local physicians with tropical and parasitic diseases.

Dr. Ana Sanchez's research into parasitic diseases in developing countries will also have health benefits for the global community.

funding profile

Canadian Institutes of Health Research	$100,000
Association of Universities and Colleges of Canada	$4,155

Brock University

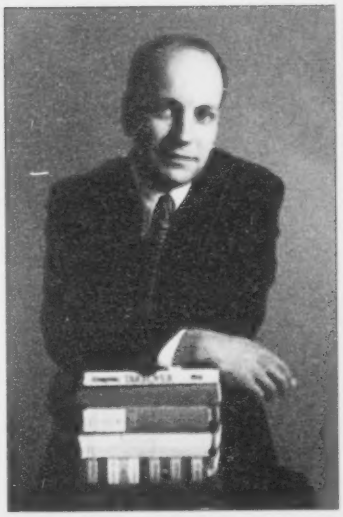
Competing Visions of Canada

As winner of a national high school essay contest, Donald Wright, now Assistant Professor of History and Canadian Studies, was flown to Ottawa to share a power breakfast with Prime Minister Pierre Elliott Trudeau. Following Trudeau's death, that experience inspired Wright to compile over 600 letters to the editor of Canadian newspapers for a scholarly assessment of Trudeau and his vision of Canada as a nation that embraced bilingualism and multiculturalism. Dr. Wright demonstrates that Trudeau's vision, shared by the majority of letter writers, made him one of the people who helped Canadians to articulate their identity of Canada.

Two other Canadians and their visions of Canada form the basis of Dr. Wright's **Social Sciences and Humanities Research Council** research. *In Donald Creighton: A Life in History*, Dr. Wright examines the life and scholarly and political contributions of Creighton, English Canada's leading historian from the 1920s to the 1970s. Creighton's well-known biography on Sir John A. Macdonald is considered one of the greatest biographies in Canadian historical writing. According to Dr. Wright, Creighton's writing was alive and energetic—"a departure from a subject associated with prose that was turgid, boring and dry."

Dr. Wright also discovered correspondence between Creighton and Eugene Forsey, a Canadian authority on constitutional matters. In a forthcoming study, entitled *Dear Donald, Dear Eugene*, Dr. Wright examines their competing perspectives on Quebec nationalism, American imperialism, Pierre Trudeau and constitutional reform.

Combined, these studies add significantly to our understanding of Canadian intellectual life from the 1930s to the 1980s.



Dr. Donald Wright is researching different historical perspectives of Canadian intellectual life from the 1930s to the 1980s.

funding profile

Social Sciences and Humanities Research Council	$28,140

Brock University

Brock Wellness Institute

Over the last five years, Dr. John Yardley, Associate Professor in the Faculty of Applied Health Sciences, has spearheaded research in the field of organizational health and strategic human resource management. As Director of the Workplace Health Research Laboratory, Dr. Yardley and his team of analysts conduct research on linking employee satisfaction and organizational health, to strategic human resource management. In partnership with the National Quality Institute, GlaxoSmithKline and the Ontario Hospital Association, Dr. Yardley has received funding from **Human Resources and Skills Development Canada** to develop an array of research tools (such as surveys and interviews) to assess the "health" of organizations.

Often, governmental, non-profit and for-profit organizations cannot benchmark their best practices against comparable organizations due to concerns for competitive advantage and confidentiality of private employee information. Recognizing these concerns, Dr. Yardley is collecting data that will allow him to develop a human resource management longitudinal and cross-sectoral database. This information resource will help more than 100 companies and public sector organizations conduct strategic and tactical planning, and then create interventions that will improve the way they manage their human resources. His research will allow employees to undertake workgroup comparisons within their own organization and then benchmark their workplace health best practices against comparable organizations, while respecting the need for confidentiality.

The goal of the research is to help organizations create healthy environments that are based on a foundation of solid, evidence-based, people-oriented strategies to attract and retain highly productive employees.

Dr. John Yardley's research will help create healthy workplace environments for employees.

funding profile

Human Resources and Skills Development Canada	$2.2 million
Private sector and government agencies	$750,770

Brock University

Icewine Research

Canada is now the world leader in icewine production, says Dr. Debra Inglis of the Department of Biological Sciences at Brock University, and we are working hard at understanding the uniqueness of our product to preserve that identity."

In collaboration with several key Niagara industries, Dr. Inglis is studying the stress responses of yeast during icewine fermentation and their impact on icewine quality. In another joint project, co-researchers Drs. Andy Reynolds, Ian Brindle and Gary Pickering aim to identify those chemical and sensory markers that are unique to Canadian icewines, including contributions from indigenous microflora during icewine fermentation.

The mission of Brock's Cool Climate Oenology and Viticulture Institute (CCOVI), with its research and teaching laboratories, pilot winery, museum artifacts, climate-controlled wine cellar and tasting facility for wine evaluation, is to meet the research and educational needs of the cool climate, grape-growing and wine-producing regions of Canada.

Supported by CCOVI's leading-edge technology, the research initiatives of Dr. Inglis and her colleagues from Brock are contributing to the understanding of volatile acidity production during icewine fermentation.

Dr. Debra Inglis in the Cool Climate Oenology and Viticulture Institute wine cellar.

funding profile

◗ Science and Engineering Research Canada	
—Strategic Grant	$744,000
—Operating Grant	$136,500
◗ Canada Foundation for Innovation/ Ontario Innovation Trust	
—Integrated Tools for Biotechnology	$5.3 million
—New Opportunities Infrastructure	$313,000
◗ Lallemand Incorporated	$3,500

Brock University

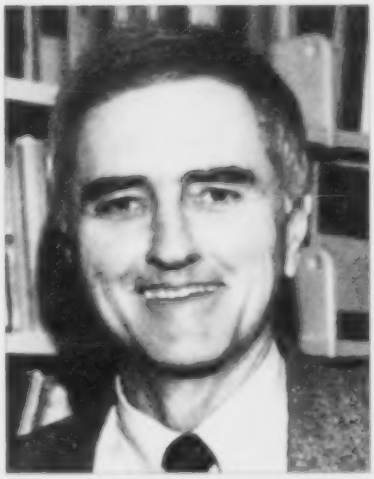
Integrating Public Service, Teaching, Research and Technology

As recent chair of the federal task force on the Disclosure of Wrongdoing, Dr. Kenneth Kernaghan recognizes the synergy between research, teaching and public service and has integrated all three in award-winning fashion. In a recent public lecture at Brock University, he noted, "My research on public service values and ethics has found that the top three values cherished in public organizations across the country are integrity, respect and accountability or responsibility. One could make a persuasive case that these should be top values in university teaching as well."

Recognized for his classroom abilities with the Award for Distinguished Teaching, Dr. Kernaghan is equally respected for his research on information technology (IT) in the public sector. His latest research project involves a team of researchers from the United Kingdom, the Canadian Public Policy Forum and professors and students from the universities of Toronto, McMaster and Brock. The team has created a web site (www.publicsectorit.ca) that focuses on the political, policy and managerial implications of advances in IT.

Dr. Kernaghan has found that the current and emerging impact of IT in the public sector has been underestimated by both public service practitioners and academic scholars. From an analysis of on-line political campaigning in recent Canadian elections, he has concluded that the U.S. is well ahead of Canada in the use of the Internet for political purposes. As well, Canada needs to pay more attention to the integration of service delivery across the Internet, telephone and over-the-counter delivery channels.

The research team's work will be reported in a book that will explore a broad range of IT issues. This book will join the numerous articles Dr. Kernaghan has written over the years as well as a textbook co-authored with Dr. David Siegel entitled *Public Administration in Canada*.



Dr. Kenneth Kernaghan is researching how advances in information technology are affecting public policy in Canada.

funding profile

- Social Sciences and Humanities Research Council
  —Principal Investigator: Prof. Sandford Borins, University of Toronto
  —Subgrant to Professor Kernaghan $75,000

Brock University

Optimizing and Understanding Human Development

The brain is the engine of human behaviour, and its functioning is inextricable from an individual's mental health. The brain not only develops rapidly in childhood but also is dynamically reinventing itself throughout life, heavily affected by its chemistry, its genetics, its experiences and whatever else the environment throws at it. Examining some of these linkages is a central theme in the work of Psychology Prof. Sidney Segalowitz. The current focus of his work involves brain maturation factors that affect the risk-taking brain, and the monitoring of one's actions in general. This research has led to collaborations with colleagues on the development of thinking as reflected in brain activation through childhood to young adulthood, and on brain responses related to the dangerous interactions of hyper-aggressive children as well as criminal psychopaths.

Dr. Segalowitz is also working on brainwave activation patterns affected by changes in dopamine levels in the brain, with Parkinson's patients and in healthy aging. These various approaches all centre on the issue of how a brain controls its own functions so well when healthy, and how this breaks down when not healthy, damaged or simply extremely tired.

Over his career, Dr. Segalowitz has partnered with members of the community, industry, hospitals, research institutes and universities. "These kinds of partnerships are so important when undertaking research that involves human development," he explains. "The impact of this research is far-reaching, and I would not be able to conduct my work without the support of people from all sectors of the population."

Dr. Segalowitz and his colleagues are spearheading a drive for a new research facility at Brock University. Expected to open in 2006, the Lifespan Development Research Centre will include labs where individuals from the community can take part in research involving the psychological and physiological aspects of development from infancy through to old age.

Dr. Sidney Segalowitz is focusing his research on brain development.

funding profile

Science and Engineering Research Canada	$88,000
Canadian Institutes of Health Research	$312,954
	$44,814
Canada Foundation for Innovation	$2.6 million
(for the Lifespan Centre)	$2.8 million
Ontario Innovation Trust Ministry of	$2.6 million
Economic Development and Trade	$2.8 million
Ontario Research and Development Challenge Fund	$83,000
U.S. National Institute of Mental Health subgrant	$9,000

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Changing the World by Remote Control

As wired and wireless networks become more powerful, and accessible and affordable network-based applications expand into new areas, several technical challenges are rapidly emerging. A number of these concerns impact the field of telehaptics—Internet-based tele-operation—and networked robotic systems, which will enable people to control a tool or robotic system remotely through the Internet.

These concerns are the focus of research by Dr. Peter Liu, **Canada Research Chair** in Interactive Network Computing and Tele-Operation. Dr. Liu's research will integrate four components: the effects of time-varying delays and non-guaranteed bandwidth of tele-operation data; data communication mechanisms that are applicable to tele-operation tasks; tele-operation-oriented interfaces between humans and systems; and network-based remote compensation control algorithms.

Dr. Liu's goal is to develop a technological framework for people to interact with the environment through networks, with applications that would include remote health care.

Dr. Peter Liu develops interfaces, remote compensation control algorithms, and data transmission mechanisms for network-based tele-operation systems that will allow people to interact through networks, such as the Internet.

funding profile

Canada Research Chair	$500,000
Science and Engineering Research Canada	$16,850
Canada Foundation for Innovation	$127,490
Ontario Innovation Trust	$127,490
Communications and Information Technology Ontario (Ontario Centre of Excellence)	$75,000
Carleton University	$15,000

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Multiple Personality Neutrinos

Einstein, Bohr, Rutherford, Fermi. These scientists changed the way we look at the universe. Following in their footsteps, Dr. Alain Bellerive is faced with the challenge of disentangling the truth about particle fusions in the core of the sun. His research investigates the properties of neutrinos using data collected at the Sudbury Neutrino Observatory (SNO). Neutrinos are uncharged elementary particles that are believed to be massless and interact only rarely with other particles.

The research conducted by Dr. Bellerive and his SNO colleagues may provide insight into neutrino properties and determine if neutrinos have mass. Established in 1992 as a joint venture by Canada, the United States and the United Kingdom, SNO is a heavy-water Cherenkov radiation detector that is built 6,800 feet underground in Inco's Creighton mine. Before SNO was established, only one type of neutrino had been detected in experiments investigating our sun. Measuring the solar reaction rates of all types of neutrinos at SNO is crucial in determining if neutrinos oscillate, and hence change personality, on their journey between the core of the sun and the Earth. Confirming the occurrence of oscillation would indicate that neutrinos have mass and would reveal new physics beyond the scope of current models of elementary particles.

With their involvement in the SNO project, Dr. Bellerive and Carleton University are at the forefront of international particle physics research.

Dr. Alain Bellerive, **Canada Research Chair** in Experimental Particle Physics, is researching the properties of neutrinos at the Sudbury Neutrino Observatory.

funding profile

Principal Investigator	
◗ Canada Research Chair	$1.4 million
◗ Canada Foundation for Innovation	$164,000
◗ Ontario Innovation Trust	$164,000
◗ Premier's Research Excellence Award*	$150,000
Co-Applicant	
◗ Science and Engineering Research Canada	$380,000
—SNO Project	$2.7 million
—Equipment Grant	$200,000
◗ FedNor	$500,000
◗ Canada Foundation for Innovation	$39 million
◗ Ontario Innovation Trust	$4.8 million
◗ Northern Ontario Heritage Fund Corporation	$4.5 million

* Two-thirds of each PREA is funded by the province and one-third is provided by the university.

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Seeking Life in the Deep Freeze

All living organisms are shaped by their environment and have their own unique way of dealing with the stresses their lifestyle demands. For organisms in cold and northern regions, survival depends on adapting to temperature extremes, oxygen deprivation and water restrictions. Dr. Kenneth Storey and his research team are exploring cell adaptations to environmental stress in animals with unique abilities. Specifically, they are studying how the brains of turtles withstand extremely low levels of oxygen; how Canadian squirrels and bats spend long winter months in deep hibernation without eating; and the evolutionary tricks used by frogs and insects to survive whole body freezing over the winter. This research will examine which genes are turned on to help these organisms survive under extreme conditions and how metabolism is regulated to maintain viability under situations that would be lethal to humans.

Ultimately, Dr. Storey and his team hope to apply what they have learned in animal cells to human cells to improve their tolerance to cold temperatures, freezing and oxygen deprivation. Discovering the genetic basis for these and other phenomena could allow us to apply new technology to human cells, and to devise better methods for freezing and storing transplantable organs.

Photo courtesy of the Ottawa Citizen

Dr. Kenneth Storey, **Canada Research Chair** in Molecular Physiology, is researching environmental stressors and cell adaptation

funding profile

Canada Research Chair	$1.4 million
Science and Engineering Research Canada	$145,500
Canadian Institutes of Health Research	$10,000
Canada Foundation for Innovation	$246,540
Ontario Innovation Trust	$246,540
Carleton University Research Achievement Award	$15,000

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Carleton Researcher Lights the Way in Photonics Fabrication Research

Dr. Jacques Albert sees a yawning gap in photonics technology that Carleton University is poised to fill in the coming years.

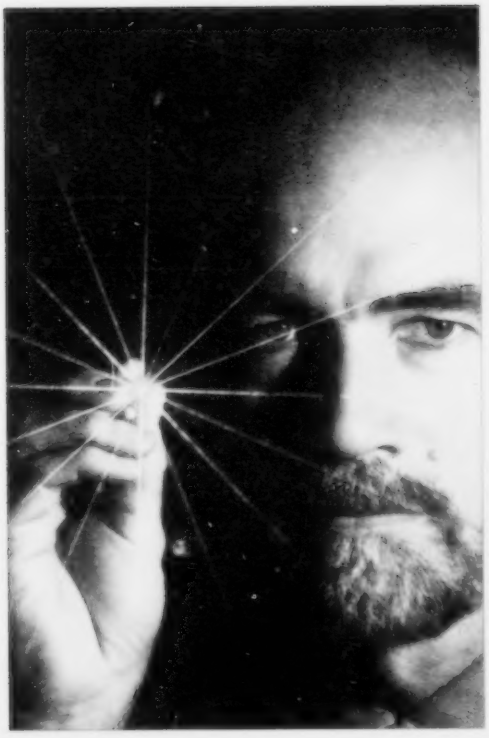
Dr. Albert, **Canada Research Chair** in Advanced Photonics Components, has twin areas of expertise: fabricating components by laser irradiation and devising airtight systems to prevent these components from degrading.

The latter has proved an elusive goal for industry. "You can have the greatest device, but it has to withstand very rigorous environments for between 15 and 25 years for it to be useful, especially in telecommunications," says Dr. Albert. "These sensitive components require very sophisticated packaging."

Dr. Albert's primary goal, beyond teaching graduate courses, is to fill his laboratory with lasers, computers, opto-electronic measuring devices and other equipment to carry out research for his two major projects: package testing and component fabrication. JDS Uniphase has donated the equipment to the laboratory.

"We want to get these components working in hot, cold, wet and dry conditions," says Dr. Albert. "Even in central office conditions, these devices must withstand 85 percent humidity, 85 degrees celsius for 1,000 to 2,000 hours, and most components cannot pass this test."

Carleton University, with a photonics group made up of 19 science and engineering faculty members, is a key partner with the **National Research Council** in the new $33 million Canadian Photonics Fabrication Centre.



Dr. Jacques Albert is focusing his research on photonics and package testing.

funding profile

Canada Research Chair	$1.4 million
Canada Foundation for Innovation	$297,768
Ontario Innovation Trust	$297,768
JDS Uniphase Corp.	$203,800
Photronics	$39,254
StockerYale	$23,179

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Do You Hear What I Hear?

Prof. Jayne Yack doesn't get squeamish around bugs; in fact she happily spends most of her days with them.

Assistant Professor in Carleton's Department of Biology, Dr. Yack researches the sense of hearing in butterflies, caterpillars and other soft larval insects. This area of study is called neuroethology, a combination of ethology (the study of animal behaviour) and neuroscience (the study of the nervous system).

For many years, it was thought that these soft larval insects couldn't hear; however, Dr. Yack has compiled evidence to the contrary. This revelation has far-reaching potential. Now that there is direct evidence that hearing organs in insects are similar to those of humans and other mammals, scientists in the United States are using flies' ears to develop miniature hearing aids.

To conduct her work, Dr. Yack uses research methods from a number of disciplines. Part of her investigation is done in the laboratory and the rest is done out in the field where she observes insects as they exist in nature. "I am actively trying to integrate methods," she says.

Recent funding from the **Canada Foundation for Innovation** and the **Ontario Innovation Trust** will establish a new laboratory. Having the necessary equipment available in Ottawa will be a huge improvement over travelling to other locations to do her research, she says.

Dr. Jayne Yack's research has proven that insects can hear.

funding profile

Science and Engineering Research Canada	$147,960
Canada Foundation for Innovation	$141,951
Ontario Innovation Trust	$141,951
Various industry sponsors	$57,400

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Northern Research Comes out of the Cold

According to Dr. Chris Burn, Carleton's **Science and Engineering Research Canada** Northern Research Chair, research in Canada's North is looking up.

In the mid-1990s, the North was considered peripheral, resulting in federal funding cuts to Northern-based research. Recently, however, several new industrial projects have renewed interest in research north of 60°. This activity is expected to increase with the proposed building of a pipeline in the Northwest Territories that will supply gas from the Mackenzie Delta area to southern markets.

Dr. Burn, Professor of Geography and Environmental Studies, researches permafrost (ground that has been frozen for two or more years) in Canada's North—how it behaves, its strength and ability to support ecological activity and how it is affected by climate change. Results from this research will speak directly to the proposed pipeline in the Northwest Territories and how it can be built safely and avoid serious environmental impact. His research into climate change will also have widespread uses in the future as the world starts to look at how to cope with this phenomenon. "Global climate change is one of the few major international challenges for which we have substantial lead time," he says. What happens in the North may be a precursor to what will happen elsewhere, and Dr. Burn's research will provide ways of dealing with our changing environment.

Dr. Chris Burn is part of the growing wave of research based in Canada's North.

funding profile

- Science and Engineering Research Canada $1.1 million
- Department of Indian Affairs and Northern Development $41,265
- BHP Billiton Diamonds Inc. $88,011

UNIVERSITY of GUELPH

Accidents Will Drive These Research Results

Intersections are a common place for motor accidents, especially with elderly drivers. In fact, seniors are 11 times more likely than younger drivers to encounter problems there. So Prof. Lana Trick, Department of Psychology, is using a driving simulator to study what elderly motorists see when navigating intersections, and to help find ways to alleviate the problem.

"It's difficult for older people when they lose their driving freedom," says Professor Trick. "To keep them on the road and safe, we must first understand what puts them at risk of an accident."

She's interested in what she calls the driver's "useful field of view," the visual area that the human mind can easily attend. Using the driving simulator and a feature that tracks eye movements, Professor Trick monitors what the driver sees—and doesn't see—in a realistic experience, complete with intersection accidents.

She believes elderly drivers look into the intersection but often don't see potential problems. Aging bodies with poor posture and neck stiffness can cause elderly drivers to look just past the hood, or improperly view approaching intersections. Car design is also partly to blame: steeply angled aerodynamic windshields reduce light entering the vehicle, creating problems for older eyes.

For many elderly drivers, the freedom to drive is essential to their well-being. Public transit has its problems too; sudden stops on buses can cause senior passengers to worry about falling. Elderly people who don't drive may even suffer a health decline.

A better understanding of elderly drivers' difficulties will improve training programs and vehicle design, says Professor Trick, allowing many motorists to continue driving for years to come.

Photo: Olivia Brown

▼ Researchers use a driving simulator to safely investigate why intersection accidents are more common with elderly motorists.

funding profile

Canada Foundation for Innovation	$267,890
Ontario Innovation Trust	$267,890
University of Guelph	$256,772
Canadian Automobile Research Simulator	$39,375
Drive Safety	$51,953
Edcom Multimedia	$3,204
Onward Computers	$3,266

UNIVERSITY of GUELPH

Lost in Translation

When cells in the human body get their wires crossed, the results can be devastating. In fact, improper signalling within cells might be responsible for many human cancers.

That's why University of Guelph Professor Roger Moorehead and graduate students Robert Jones and Nicolle Linnerth, Department of Biomedical Sciences, are working to determine how this faulty signalling promotes breast and lung cancer.

Specifically, they're studying a family of proteins called insulin-like growth factors (IGFs), which help determine whether cells should proliferate, differentiate or die. These proteins have been linked to human tumour development.

For their research, Professor Moorehead's team studied genetically modified mice with high levels of IGFs or IGF receptors. One group of mice developed mammary tumours after only 55 days. Another group developed tumours on the lung after only six to 12 months.

This suggests that IGFs play an important role in the development of tumours. But researchers now want to know what signals or pathways are being turned on by IGFs to promote tumour development—and how.

This research enables the study of cancer as it arises in cells, before those cells form tumours. In contrast, human tumour samples typically only represent advanced stages of the disease.

The team is confident this research will help with improved cancer therapies and prevention techniques.

"Getting results like this has been very rewarding," says Jones. "It's very motivating to feel as if what you're working on in the lab is important."

Photo: Martin Schwalbe

Prof. Roger Moorehead is studying improper cell signalling in mice—and the implications it may have for human cancers.

funding profile

- Canadian Institutes of Health Research $296,969
- Canada Foundation for Innovation $127,656
- Ontario Innovation Trust $127,656

UNIVERSITY of GUELPH

Guelph Researchers Wage War on the Waistline

Study after study yields the same result: we eat too much and exercise too little. And a consequence of our bulging waistlines is the prevalence of type II diabetes, affecting over two million Canadians and costing $9 billion US annually.

"We eat too much for the activity level we maintain," says Prof. Lawrence Spriet, Department of Human Biology and Nutritional Sciences. "There's too much ease in our society and too much fat in our diets."

Professor Spriet, postdoctoral fellow Rebecca Tunstall and McMaster University Professor George Heigenhauser are examining how adrenaline and exercise affect fat breakdown in muscle in lean, obese and type II diabetic individuals. Muscle normally burns varying proportions of fat and carbohydrates, depending on availability and energy needs. But obese and type II diabetic patients lose this flexibility and can't burn fat normally. They're also resistant to insulin—the hormone that signals cells to take glucose from blood—causing blood sugar levels to rise, and thirst, hunger, frequent urination and fatigue to increase.

Adrenaline and exercise normally activate a crucial fat-burning enzyme. However, Professor Spriet and Dr. Tunstall suspect that obese and type II diabetic individuals are less sensitive to adrenaline's effects. But they believe that regular exercise—with its ability to increase muscle's fat-burning ability—may restore the enzyme's function, helping to fend off the effects of overeating.

They're testing subjects on a cycling program to determine the fat-burning enzyme's function before and after regular exercise. They're also testing insulin resistance, body composition and improvements to fat-burning ability.

"The body adapts to the stresses it's under," says Professor Spriet. "Challenging the body with exercise promotes health. It's an important way to maintain one's ability to break down fat."

▼ With the help of test subject Rob Moreland (right), Dr. Rebecca Tunstall and Prof. Lawrence Spriet are looking at how hormones and exercise can help people who are obese or type II diabetic.

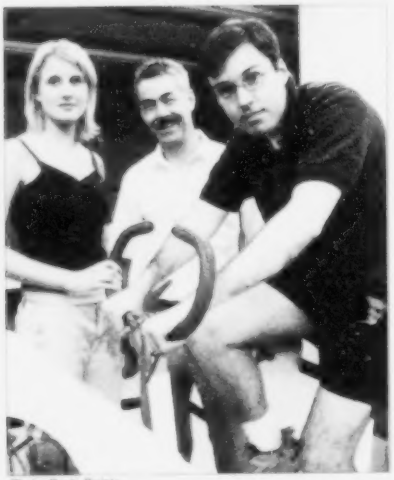


Photo: Paula Bialski

funding profile

- Canadian Institutes of Health Research $277,359

UNIVERSITY of GUELPH

Breakthrough DNA Bar-Coding Methods Reveal New Species

The world of zoology is changing by the moment, thanks to University of Guelph Prof. Paul Hebert. Using a technique called DNA bar-coding, he has already discovered several new species of birds, butterflies and fish.

"DNA bar-coding enables the rapid screening of large numbers of organisms and highlights those with novel bar codes that are likely to be new species," he says.

Professor Hebert was the first scientist to propose that a short DNA sequence from a gene found in all animals could be used to identify species. Through DNA bar-coding, species could be identified as quickly as retail bar codes identify millions of items on store shelves.

Professor Hebert and his colleagues examined 260 North American species using this methodology. They found distinct genetic markers indicating that four existing species—solitary sandpiper, eastern meadowlark, marsh wren and warbling vireo—should each be divided into two more species.

"The fact that we found four new species in this sample suggests that a global survey would likely lead to the discovery of at least 500 unrecognized species of birds on the planet," says Professor Hebert. His research group has also identified several new fish species.

According to Professor Hebert, DNA bar-coding has several advantages over traditional identification methods. It requires only a small sample of tissue and accurately identifies organisms at different stages of life.

In the next 20 years, Professor Hebert estimates that the bar-coding technique could catalogue the projected 10 million species of animals on the planet—of which only 1.2 million have been formally identified over the past 250 years. He and other scientists have already begun to establish a public online database that includes DNA bar code sequences of known and newly discovered plant and animal species. Ultimately, they expect inexpensive hand-held devices will allow lay users to perform DNA analysis as well.

Photo: Martin Schwalbe

Prof. Paul Hebert has found several new bird and fish species using his DNA bar-coding technique.

funding profile

Canada Research Chair	$1.4 million
Canada Foundation for Innovation	$5.1 million
Ontario Innovation Trust	$5.1 million
The Gordon and Betty Moore Foundation	$3.3 million
The Alfred P. Sloan Foundation	$60,000

UNIVERSITY of GUELPH

Seniors: They Know When to Fold 'Em

Seniors who gamble are often stereotyped as being vulnerable to addiction and financial problems. But University of Guelph Professors Joan Norris and Joseph Tindale, Department of Family Relations and Applied Nutrition, have found that's a misconception—instead, most senior gamblers they surveyed keep their hobby under control.

"We live in an ageist society and there has always been a stereotype surrounding seniors," says Professor Tindale. "People view them as vulnerable, incompetent, in need of help. That's not the case at all."

Adds Professor Norris: "Within the gambling population, seniors tend to have a steady retirement income. They are quite capable of taking care of themselves."

Initially, the researchers surveyed seniors in different southern Ontario communities and found that most favour group excursions to racetracks with slot machines. The majority view gambling as a way to socialize with friends, and set strict gambling limits of about $50—which the researchers say puts them at very low risk for problem gambling.

In their newest study, Professors Norris and Tindale are setting out to create a profile of older gamblers in small-town Ontario. Of the 24 casinos and racetrack slots in the province, 21 are located in small or rural communities, where there are larger populations of seniors and fewer entertainment options. The researchers will survey members of seniors clubs in seven Ontario rural counties with gambling facilities to assess gambling attitudes, practices and risk status.

They're also compiling data to get a sense of how family patterns of gambling affect people's gambling habits and their attitudes toward gambling.

"We're interested in family relationships, and mainly the intergenerational relationship of adult children and their parents when faced with the topic of gambling," says Professor Tindale. "We hope that our study will help us understand whether gambling has a positive or negative effect on these relationships."

Photo: Vince Filby

Prof. Joan Norris (left), graduate student Jonathan Schmidt and Prof. Joseph Tindale have found that seniors who gamble are at very low risk for problem gambling.

funding profile

- Ontario Problem Gambling Research Council $162,352

UNIVERSITY of GUELPH

Chemist Puts Atoms in Their Place for Smaller Electronics

Laptop lovers and palm pilot junkies, take note: chemical compounds being developed at the University of Guelph may one day spawn a new generation of miniature electronic devices.

Prof. Michael Denk of the Department of Chemistry is using a technology called chemical vapour deposition (CVD) to create metal films thousands of times thinner than a human hair, for ever-smaller microchips. It's becoming a key process for manufacturing ultra-pure electronic-grade materials.

He's particularly interested in using CVD with metal amido complexes—unusual chemical compounds with nitrogen atoms bonded directly to metal atoms. Amido complexes are volatile—meaning they're readily vapourizable at relatively low temperatures—so they can be used to deposit copper, silver or gold films onto surfaces to potentially produce smaller and more intricate microchips than ever.

"Amido complexes allow us to make almost any element in the periodic table volatile," says Professor Denk. "They play a small role now, but in the future we'll need a lot of them to create thin films and develop the next generation of microelectronic devices."

Microelectronics manufacturers strive for miniaturization because it allows them to pack more transistors into devices for greater technological power. Traditionally, they've reached this goal using an electrically based copper process. But instruments for such processes are too big to build microelectronic devices, which contain millions of atoms in exactly the right places.

CVD has become crucial for positioning atoms to create thin films, says Professor Denk. He has already developed a new class of silicon compounds, and invented a process to deposit germanium films used for fibre optics, hard coatings, microchips and semiconductors.

The next stage in Professor Denk's CVD research involves testing and optimizing his new amido complexes. He hopes they'll eventually be suitable for large-scale processes that inexpensively produce tiny, high-performance devices such as new microchips and solar cells.

Photo: Vince Filby

Thinking small: Prof. Michael Denk is exploring new chemical technologies that may lead to ever-smaller microchips.

funding profile

Science and Engineering Research Canada	$177,500
National Research Council Industrial Research Assistance Program	$100,000
Premier's Research Excellence Award*	$150,000

* Two-thirds of each PREA is funded by the province and one-third is provided by the university.

Lakehead
UNIVERSITY

Lakehead Applies Remote Sensing Technology to West African Bushfire Problem

West Africa's savanna woodlands are under intense pressure and subject to substantial degradation. A principal cause of the problem is uncontrolled, large-scale bushfires. Generally, local populations are not aware of the extent of such fires and government agencies' capacity to adequately monitor the issue is limited.

Funding from the **Canadian International Development Agency** has led to the development of digital tools to monitor bushfire and land-use changes in Ghana's savanna woodlands through remote sensing technology. Dr. Ulf T. Runesson is leading this key initiative, in concert with his Ghanaian partners. Their research is based on a time-series analysis of multi-seasonal satellite imagery over a 30-year span.

This initiative has confirmed an increasing trend in the extent and frequency of bushfires in northern Ghana leading to less tree coverage and fewer tree species.

Remote sensing technology has also enabled the assessment of economically large geographic areas in terms of land degradation and productive capacity. This, in turn, will provide an effective tool not only for community education initiatives but also for government to develop land conservation programs and policies for a vast area of the West African land base.

Dr. Ulf T. Runesson is using digital tools and remote sensing technology to assess West Africa's savanna woodlands.

funding profile

Canadian International Development Agency	$2.5 million

Lakehead
UNIVERSITY

Listen Up: Helping Prevent Hearing Loss in Aboriginal Children

Lowering the prevalence of middle ear disease—Otitis Media (OM)—by increased breast-feeding and second-hand smoke abatement are health initiatives promoted by Dr. Alan Bowd, Research Director, Centre of Excellence for Children and Adolescents with Special Needs at Lakehead University. OM among children causes hearing loss, language challenges and learning difficulties. Hearing loss is greatest among Aboriginal populations; in Canada between 8% and 45% among the Inuit are affected.

Dr. Bowd has produced various materials to assist in the prevention and intervention of OM in Canada that have been disseminated through workshops, mailings and downloads (www.lcnorth.ca). *Coping with Middle Ear Disease in the North: A Video Workshop for Health and Educational Professionals* was funded by the Children with Special Needs Branch, Government of Ontario. The video was delivered to schools and nursing stations in Northwestern Ontario, Manitoba and Nunavut. A literature review, *Otitis Media: Its Health, Social, and Education Consequences Particularly for Canadian Inuit, Métis, and First Nations Children and Adolescents*, was published in 2001. This review led to the Young Mothers Project funded by a **Canadian Institutes of Health Research** Development Grant.

The Young Mothers exploratory investigation involved 42 young mothers and pregnant adolescents attending the Winnipeg Adult Education Centre. Culturally sensitive methods and materials were important for the participants since 80% were of Aboriginal descent. A graduate student assisted with conducting focus groups, managing data, developing promotional materials and working within granting timeframes.

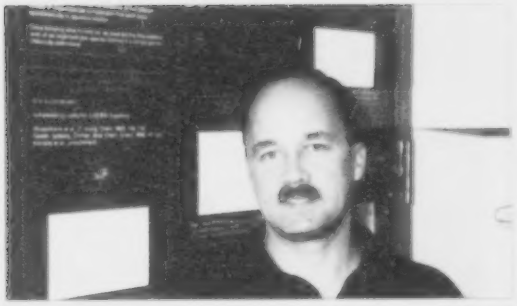
The study resulted in positive changes in the participants' attitudes and behaviour around increasing breast-feeding and reducing a baby's exposure to smoke in preventing OM. It also resulted in the establishment of a series of workshops for health professionals and educators.

Dr. Alan Bowd is researching middle ear disease among Canada's Aboriginal population.

funding profile

- Health Canada, Infrastructure funding to the Centre of Excellence for Children and Adolescents with Special Needs — $3.5 million
- Canadian Institutes of Health Research — $20,000
- Integrated Services for Children Division, Children with Special Needs Branch, Government of Ontario — $12,000

Lakehead
UNIVERSITY



Dr. Stephen Kinrade's research into silicates is revealing new cross-disciplinary benefits.

Surprising Silicon Chemistry

It's a researcher's dream—pursuing a line of inquiry as it branches and forks, making new and surprising connections between disciplines once thought to have been distinct. Dr. Stephen Kinrade of Lakehead University's Department of Chemistry is among the lucky. His study of silicates has led to exciting discoveries and collaborations in the fields of geology, chemistry, physiology, botany and nutrition, as well as numerous industrial and technological applications.

As an undergraduate student, Dr. Kinrade became intrigued by the unusual properties of a group of microporous silicate minerals known as zeolites. "With zeolites, you can selectively remove the molecules you don't like from a complex mixture and rebuild them into molecules you do like. Synthetic forms of these minerals have exciting applications in the petroleum and chemical industries. For example, zeolites can be used to boost the octane rating of gasoline without using toxic additives."

Through his research in this area, silicon, which was previously thought to play no role in biochemistry, was found to react with a number of sugars and sugar-derivatives. "You've got the most important part of the inorganic world, silicon and silica, reacting with the most important part of the organic world," he explains.

The findings sparked the interest of researchers of diverse backgrounds, including plant physiologists, nutritionists, geochemists and materials scientists. "Our work was the catalyst to help bring them together." Dr. Kinrade's conference on the chemistry and biochemistry of aqueous silicon, to be held December 2005 in Honolulu, will be a meeting place for silicon scientists from these various fields.

In addition to studying the potential use of soluble silicates as fertilizer, Dr. Kinrade is investigating the biological role of silicon in plants. "Cereal crops in particular require substantial amounts of silicon to defend against disease and other stresses, but no one knows exactly why. We're now very close to saying what silicon does at the cellular level."

Dr. Kinrade and his collaborators are also studying silicon's potential role in promoting bone growth and treating osteopotosis. Some of his past research initiatives include work with the pulp and paper industry (where silicates are used in the bleaching process), and participation in the research stemming from the silicone breast implant controversy.

funding profile

- Science and Engineering Research Canada $238,320

Lakehead
UNIVERSITY

Creating a Safer Food and Water Supply for Canadians

Dr. Heidi Schraft, Associate Professor in Biology at Lakehead University and a **Canada Research Chair** in Molecular Food Microbiology, is leading research that will provide safer food and drinking water for Canadians. Her interdisciplinary research deals with the study of biofilms and their ability to transmit disease-causing pathogens.

Biofilms are layers of organic material that form when bacteria coalesce and bind to different surfaces. Problems arise when biofilms containing harmful pathogens form on or near sensitive waterways or food sources because of a troubling characteristic that they possess. "Sanitizers or antibiotics that easily kill free-floating bacteria have a much more difficult time killing the same bacteria when they form a biofilm," explains Dr. Schraft. Once the biofilms form, they proliferate and release pathogens into their surroundings.

"My research looks at understanding how bacteria form biofilms," says Dr. Schraft. "Once we understand this process, we hope to find new ways to intervene and prevent it from happening. This is a very fundamental approach to doing things." This knowledge will aid material scientists in the development of more effective sanitizers and surface coatings to protect against the transmission of harmful bacteria into food and water sources.

It is now believed that the E. coli bacterium and another food-borne pathogen, Campylobacter, were able to persist in biofilms that had formed in the water distribution system in Walkerton, Ontario, causing the recent outbreak. In unlocking the mystery of biofilm formation, Dr. Schraft and her team of graduate students hope to shed light on this recent bacterial epidemic and prevent future harm.

Dr. Heidi Schraft is researching how bacteria form biofilms—a more dangerous type of pathogen.

funding profile

Canada Research Chair	$500,000
Science and Engineering Research Canada	$150,000
Advanced Foods and Materials Network (Networks of Centres of Excellence)	$316,000
Ontario Ministry of Agriculture and Food	$77,500

Laurentian University / Université Laurentienne

Understanding Human Cognition: Culture, Technology, Imagination and the Corporeal Mind

Professor at Laurentian University's Ecole des sciences de l'éducation since 1992, Dr. Luis Radford is a world-recognized mathematics educator who conducts groundbreaking research on the development of mathematical thinking. With a unique interdisciplinary expertise in the history of mathematics, psychology, semiotics, phenomenology and epistemology, Dr. Radford has contributed in a decisive way to formulating a new approach to the problem of knowledge growth. In his approach, the production of knowledge is regarded as a sociocultural process that rests on the metaphor of a "corporeal mind"—a mind shaped by two basic overlapping dimensions of all human activity, the technological and the symbolic.

A regular **Social Sciences and Humanities Research Council** grant recipient, Dr. Radford is currently investigating the role played by body movement, technology, symbols and language in high school students' construction of abstract mathematical knowledge. Language, body and tools are seen not merely as aids to knowledge acquisition, but rather as an original way of intending, imagining and moulding ideal objects. Body motion, gestures and the like constitute a non-written, non-traditional and non-linear "mathematical text" having a powerful mode of expressivity different from that of the written tradition.

Dr. Radford's work has impacted the training of PhD students, furthered our understanding of human cognition and provided valuable ideas on how to improve instruction. Following a recent province-wide classroom-based research project, the Ontario Ministry of Education commissioned Dr. Radford to write a book on communication in mathematics that will be made available to all teachers in Ontario.

Dr. Luis Radford is formulating a new approach to the problem of knowledge growth.

funding profile

Social Sciences and Humanities Research Council	$144,165

Laurentian
UNIVERSITY/UNIVERSITÉ
Laurentienne

Deciphering Data Logged in Ancient Fossil Reefs

Dr. Paul Copper's work, which has been described in over 120 papers, focuses on the effects of global climate change on tropical marine ecosystems and ancient episodes of global mass extinctions. He is particularly interested in the 120 million-year-long Early and Middle Paleozoic period—some 470 to 355 million years ago—a time when the global temperature was 4 to 8°C higher than today, when sea levels were 160 to 170 metres higher, when there were no ice caps on any continents, when Canada straddled the Equator and when Northern Ontario was flooded by warm seas.

High-precision equipment enables Dr. Copper to read the data preserved in the minute crystals of brachiopod shells and helps him understand in more detail how coral and sponge reefs (as well as microbial reefs) expand and how they completely disappeared during mass extinction periods. Oceanic calcite saturation levels and stable oxygen and carbon isotopic signatures, for instance, yield highly instructive clues to the global climate, sea surface temperature and ocean productivity of the period encompassed by his research.

His work is of broad interest to the oil and petroleum industry because it provides a more complete picture of what to look for when drilling in carbonate reservoir rocks. Exposed reefs—the result of dramatically lower sea levels or tectonic upheaval—are target models for petroleum geologists. The one-trillion barrel reserve of Mesozoic tar sands of Western Canada—the world's largest oil deposits, greater than the Saudi reserves—are the results of oil seeping from Paleozoic reefs.

Dr. Copper's expeditions have brought him to over 160 countries, enabling him to build an extremely rich global database—in English, Russian and Chinese literature—on coral and sponge reefs, a database that is used by scientists throughout the world.

Dr. Paul Copper is investigating the impact of climate change on tropical marine ecosystems.

funding profile

- Science and Engineering Research Canada $286,800

Laurentian University
Laurentienne

Making Sense of Muscle Architecture

Dr. Céline Boudreau-Larivière, a Professor at Laurentian University's School of Human Kinetics since 2002, is a physiologist by trade. During her graduate training, she studied various aspects of skeletal muscle physiology using both cellular and molecular biology approaches. Her doctoral studies focused on the establishment and maintenance of the neuromuscular junction whereas her postdoctoral training emphasized the study of architectural molecules in skeletal muscle.

Just like the architectural framework needed to assemble and support a building's components, individual cells that make up an organism possess their own internal support system known as the cytoskeleton. The cytoskeleton is especially important in maintaining the structural integrity of cells that undergo significant mechanical stress such as skeletal muscle cells during cycles of muscle contraction and relaxation. Structural support is conferred by a series of interconnected molecules. Dr. Boudreau-Larivière is currently studying the function of one of these cytoskeletal molecules, namely Bpag1 (bullous pemphigoid antigen 1). There exist several variants of this molecule, one of which is targeted in a human autoimmune skin blistering disease known as Bullous pemphigoid.

Bpag1 has the ability to simultaneously interact with various components of the cytoskeleton and is therefore referred to as a cross-linking protein. When Bpag1 is absent, skeletal muscles are weak and display abnormal architectural features. Dr. Boudreau-Larivière's research will focus on the function of Bpag1 in contractile cells, thereby furthering our knowledge of the role of cross-linking proteins in muscle physiology.

▼ Dr. Céline Boudreau-Larivière is researching the architecture of muscle physiology

funding profile

- Science and Engineering Research Canada $108,000
- Canada Foundation for Innovation $35,700
- Ontario Innovation Trust $35,700

Laurentian University / Université Laurentienne

Understanding the Factors that Influence Recruitment and Retention in Oncology Nurses

Meeting the goal of cancer control in Canada requires the dedication of a team of health care professionals. As a member of this team, the oncology nurse with specialized knowledge and skills plays a crucial role in meeting the complex needs of cancer patients and their families. But, the steady rise in the number of cancer cases together with the nursing shortage is putting the quality of cancer care programs in Canada at risk. For this reason, Dr. Debra Bakker is leading a national team of researchers to address ways to build and sustain a quality oncology nursing work force in Canada.

To date, research on nurses' workplaces has mainly focused on nurses as a group. Dr. Bakker's project is focusing on the work environments of oncology nurses.

The first phase of the study surveyed oncology nurses across Canada to produce a profile of how workforce management, professional practice and knowledge translation affect the quality of these nurses' work lives. The second phase used focus groups made up of oncology nurses and decision-makers to gain a better understanding of what attracts nurses to the specialty of oncology, and what workplace and professional factors influence their continued employment. It is expected that the project will lead to innovative, pragmatic strategies to strengthen oncology practice environments and contribute to recruiting and retaining a quality Canadian oncology nurse workforce.

Dr. Debra Bakker and her team's research will ensure the retention of motivated and skilled nurses for cancer care in Canada.

funding profile

- Canadian Health Services Research Foundation $100,000
- Ministry of Health and Long Term Care $100,000

Laurentian University / Université Laurentienne

Integrating a Spiritual Dimension into the Healing Process

When it comes to spirituality, Dr. Diana Coholic has a progressive outlook. An Assistant Professor of Social Work at Laurentian University, Dr. Coholic is interested in alternative health practices, and her focus is on holistic helping. She is one of a few researchers in Canada working to develop empirically based practice knowledge in the emergent field of spiritually influenced clinical social work. "Essentially, the goal is to help people become more self-aware," she explains.

Although researchers are beginning to study connections between the mind, body and spirit, little is known about how the inclusion of spirituality actually shapes the therapeutic helping process. The principal idea behind Dr. Coholic's work is that a connection with one's "higher-self" enables people to better understand their emotions, thoughts and behaviours, leading to a greater sense of self-esteem. "For some people, spirituality is a religious matter, but for others it is another matter altogether and does not necessarily mean something religious," explains Dr. Coholic. The central theme of her research is on helping individuals to connect with, and express, all the dimensions of their lives by way of experiential processes such as meditation, dream work, mindfulness practice and the use of expressive arts.

Participants engaged in directed discussions are observed and recorded through a two-way mirror, using microphones, cameras and a DVD recorder. The video records are used to quantify participant responses, to better understand how the spiritually influenced therapeutic process unfolds. The research is intended to assist practitioners to be as helpful as possible, ensuring that mental health professionals continue to have a viable role in health care, particularly "within a Northern Ontario context."

Dr Diana Coholic's research explores the spiritual dimension in social work practice

funding profile

Canada Foundation for Innovation	$15,658
Ontario Innovation Trust	$15,658

Laurentian
UNIVERSITY • UNIVERSITÉ
Laurentienne

Studying the Genome of Trees to Promote the Restoration of the Environment

For Dr. Kabwe Nkongolo, environmental rehabilitation is a top priority. A plant geneticist and Biology Professor at Laurentian University, Dr. Nkongolo studies the genetic structure of Northern Ontario forests that have been negatively affected by pollution, mining and forestry.

In his current research, Dr. Nkongolo is trying to determine the nature of the link between genetic instability and heavy metal accumulation. The ultimate goal is to increase the genetic diversity of plant populations growing in contaminated areas. "The data collected during the study will assist in establishing current baseline information for evaluating abatement procedures," he explains. The application of this research is critical in restoring damaged environments, which require adequate genetic variation within plant communities for them to remain sustainable. In populations where variation is not present, his research will focus on identifying ways of restoring and replenishing the genetic variation needed for a sustainable environment.

Dr. Nkongolo's primary interest, however, lies in the mapping of conifer genes, specifically black and red spruce. The conifer research is expected to lead to viable alternatives and stronger trees; it will also assist the international effort to map conifer genomes. He has devised biomarkers to detect and certify pure seeds and seedlings to develop uncontaminated tree strains. Over 20 students from Northern Ontario have been trained in environmental genetics in his lab.

Dr. Nkongolo's expertise in plant genetics has led to international projects resulting in five sorghum and six cowpea varieties resistant to drought, insects and disease and with high yield and high protein content, for Southern Africa. His international involvement has led to partnership agreements with African universities to build their capacity to enhance their food security and natural resources management.

Dr. Kabwe Nkongolo and students in his laboratory

funding profile

Science and Engineering Research Canada	$282,493
—Collaborative Research and Development	$96,000
Canadian International Development Agency	$1.4 million
International Development Research Centre	$153,300
Agence Francaise de la Francophonie	$3,500
INCO	$48,000
Falconbridge Ltd.	$48,000

Travelling Back Through Time to Benefit the Future

Fossils provide us with a window into the past, sparking both our imagination and our interest in the science that unravels their secrets.

Geneticist and bioanthropologist Hendrik Poinar has always been fascinated with time travel. Unlike H.G. Wells' time traveller, however, Professor Poinar hasn't built a time machine to the future—he's built a million-dollar molecular anthropology lab dedicated to the chemical and molecular analysis of ancient DNA from forensic, archeological and paleontological fossil remains.

From this lab, Professor Poinar and his research team are in the midst of intriguing studies, teasing out biomolecular information and extracting DNA from fossils to answer important questions about our recent past, such as why North American mammoths, horses, camels and sloths went extinct and if Neanderthals could speak.

Professor Poinar chose McMaster University over offers from universities such as Oxford and Berkeley, largely because the grants he was awarded enabled him to build a lab that is among the world's most sophisticated at detecting the genetic material of fossilized feces, or coprolites.

Professor Poinar developed a novel technique to chemically trap the coprolite DNA that has provided a rich archive of genetic information. He uses these analyses to address evolutionary and anthropological questions that range from the diet and gender differences of hunter-gather populations to the language abilities of Neanderthals to whether or not early humans interbred with Neanderthals.

He is also analyzing archival samples of Human Immunodeficiency Virus (HIV) collected between 1959 and 1980 in the Democratic Republic of Congo. His goal is to provide a more accurate study of the evolution, mutation rate and time of transfer of Simian Immunodeficiency Virus (SIV) to humans and the origins of HIV.

Photo: Chantal Van Raay

Prof. Hendrik Poinar holds a 9,000-year-old human feces fossil in his right hand and a 30,000-year-old cave bear tooth in his left.

funding profile

Social Sciences and Humanities Research Council	$250,000
Science and Engineering Research Canada	$229,715
Canadian Institutes of Health Research	$356,000
Canada Foundation for Innovation	$120,000
Ontario Innovation Trust	$120,000
Petro-Canada Award	$25,000

The Power of Exercise

The power of exercise cannot be overstated and few know that better than Dr. Kathleen Martin Ginis, Associate Professor of Kinesiology. She knows, from years of research, the importance of exercise and the benefits it can offer to all people—particularly those people with spinal cord injury (SCI).

Dr. Martin Ginis and her colleagues at McMaster's Centre for Health Promotion and Rehabilitation—one of only five international centres of its kind—concluded in a study published in the journal *Spinal Cord* that participation in exercise has both physical and psychological benefits for people with paraplegia and quadriplegia.

Dr. Martin Ginis found that when people with spinal cord injuries participated in twice weekly exercise, their strength and endurance increased, their mood improved, and they managed their pain better. Quite simply, exercise made their daily lives easier. A subsequent study, published in *Rehabilitation Psychology*, showed that after three months of participation in this exercise program, the participants' pain and stress decreased and, in turn, improved their quality of life.

Unfortunately, despite the benefits, many people with spinal cord injury don't participate in exercise because finding and accessing an exercise centre can be a real challenge. That just doesn't sit well with Dr. Martin Ginis, so she's launched Get Active Your Way—a new study that provides people with SCI help over the telephone and Internet to set up their own home based exercise program.

And while the success of her research can be measured by the benefits to the participants, it can also be measured by the people Dr. Martin-Ginis attracts to work with her—people such as PhD student Amy Latimer, who received a rare "perfect score" on her **Social Sciences and Humanities Research Council** postdoctoral fellowship application. Latimer will use the funds to study health communications strategies at Yale, but plans to return to Canada to work as a professor.

Dr. Kathleen Martin Ginis has launched a new exercise program for people with spinal cord injuries.

funding profile

Canadian Institutes of Health Research	$466,595
Social Sciences and Humanities Research Council	$168,966
Ontario Ministry of Transportation	$25,000
Canadian Arthritis Society	$207,554
Heart and Stroke Foundation	$203,205
Ontario Neurotrauma Foundation	$55,000
Danone Institute of Canada	$29,800
Rick Hansen Neurotrauma Initiative Grant	$102,070
Christopher Reeve Paralysis Foundation	$15,000

E-Business: It's a Matter of Trust

How do we build trust in a virtual environment? How can the interface be designed to help instill this trust? How do Canadians adapt to and adopt new technologies, and how does this differ in other cultures?

Dr. Milena Head spends a lot of her time trying to answer these questions. She's an expert on electronic business issues and is fascinated by the human-computer interaction. She's also the Director of the McMaster eBusiness Research Centre (MeRC) that provides leadership and infrastructure support for innovative e-business research to academic and industry partners.

Dr. Head's main goal is to make the human-computer interaction more friendly and productive. Her research in e-business examines a full range of issues from technology adoption and web site usability, to privacy concerns and building trust in online and offline environments. She's also interested in privacy, trust and usability issues as they relate to mobile commerce.

Trust is a critical component for any business transaction but it's particularly essential in the e-commerce environment where transactions are more impersonal, anonymous and automated. Dr. Head has systematically examined how features of the web interface can be manipulated to instill a feeling of trust. Her research shows that a socially rich interface, which conveys a sense of human warmth and sociability, can help engender trust in the online environment. Online stores can instill "social presence" by simply depicting products with people in emotional and dynamic settings and by providing descriptions aimed at evoking positive emotions. In turn, users are significantly more inclined to trust that online store and, subsequently, to make a purchase.

▼ Dr. Milena Head researches electronic business issues.

funding profile

◗ Science and Engineering Research Canada	$72,000
◗ Social Sciences and Humanities Research Council	$81,130

Exploring on a Small Scale

Nanotechnology—the use of materials developed on a scale of one-billionth of a metre—holds the promise of stronger materials, faster computers, better energy efficiency and a cleaner environment.

Canada Research Chair (CRC), Dr. Gianluigi Botton has developed advanced techniques for using electron microscopes that provide very high spatial resolution information on the structure of materials, including transmission electron microscopy and electron energy-loss spectroscopy.

His research is guaranteed to change the way we look at materials and having him conduct this research in Canada guarantees we'll be at the forefront of discoveries.

As a direct result of his **CRC**, Dr. Botton won a **Canada Foundation for Innovation** award—enabling McMaster to purchase the world's most advanced electron microscope and begin research using its unique capabilities.

This microscope will attract researchers from around the world and enable McMaster to become a training ground for new generations of researchers to study materials at an unprecedented resolution. The announcement of this microscope has already put Ontario, and indeed Canada, on the world stage as leader in this field and will give numerous Canadian researchers a clear advantage in this exciting area of science.

Dr. Botton is leading the project, which involves more than 90 researchers from 24 universities across Canada.

▼ Dr. Gianluigi Botton is at the forefront of electron microscope research.

funding profile

Canada Research Chair (2002–2007)	$500,000
Science and Engineering Research Canada (2002–2006)	$265,000
Canada Foundation for Innovation	$7.1 million
Ontario Innovation Trust (committed to date)	$3.5 million

McMaster University

Inspiring Innovation and Discovery

Allergies Nothing to Sneeze at

Hay fever, asthma, eczema and food allergies are reaching epidemic levels throughout the western world and scientists are puzzled as to why this is the case. The mystery may soon be unravelled thanks to research being carried out through McMaster-based AllerGen—a national **Network of Centres of Excellence** focusing on allergies, genes and the environment.

The driving force behind AllerGen is its Scientific Director, Dr. Judah Denburg, Professor of Medicine in McMaster's Michael G. DeGroote School of Medicine and Director and Clinical Chief of Immunology and Allergy at Hamilton Health Sciences.

According to Dr. Denburg, scientists around the globe don't yet understand what is happening, although the "hygiene hypothesis" is currently a popular explanation. It suggests our immune systems have become lazy because of our urban lifestyle with its emphasis on cleanliness, coupled with an overuse of antibiotics.

Beyond the personal suffering, says Dr. Denburg, is the enormous economic impact of allergic diseases. In North America, lost workplace productivity and employee and school absenteeism cost more than $600 million a year, with over $5 billion spent on medical care alone for millions of children.

Allergen's research will focus on five themes: genes and early life; environment, population and society; biological mechanisms; therapeutic and drug discovery programs; and prevention, control and public policy. It will also address the critical shortage of physicians and professionals treating allergies by increasing the number of trained specialists; teaching primary care physicians; increasing the number of basic laboratory scientists holding graduate degrees; developing certification for allied health professionals; and attracting young talent at the undergraduate level into the field.

Fourteen Canadian universities, 23 industries and 18 government department and agencies make up AllerGen.

Dr. Judah Denburg is researching the growing number of allergies affecting the Western world.

funding profile

Networks of Centres of Excellence	$21 million

McMaster University

Inspiring Innovation and Discovery

Building a Bully-Free Community

The gloves are off. While there's zero tolerance for bullying in many Canadian schools, research indicates that this approach alone is not enough. The sad reality is that one out of every 10 children is bullied on a weekly basis.

This kind of torment can have lasting social and emotional implications for a child's educational success and personal well-being. Psychologist and bullying expert Dr. Tracy Vaillancourt believes that linking research to the community can result in sustainable, long-term solutions to reduce bullying and ultimately improve the lives of children.

Dr. Vaillancourt's vision involves a systemic approach to bullying, one in which the community—not just educators—are engaged in preventing this universal problem.

Her latest project entitled Toward a Bullying-Free Hamilton was recently awarded $1 million (over five years) by the **Social Sciences and Humanities Research Council**. Its Community-University Research Alliances (CURA) program promotes research and social innovation—an ideal fit for Dr. Vaillancourt and her team of 21 co-investigators, 13 collaborators and 26 community partners.

This vital and creative partnership seeks to build community awareness and understanding of the serious impact of bullying; examine the prevalence of bullying both within and outside school; investigate the factors that influence bullying and victimization; and evaluate the effectiveness of community-based initiatives to reduce bullying.

Dr. Vaillancourt is no stranger to ambitious community-based projects. For the last two years, she has been actively involved in organizing the world's largest anti-bullying seminar in conjunction with the world's largest university basketball game.

Dr. Vaillancourt's CURA study will also follow large groups of children from various age groups for a period of four years to examine their individual experiences with bullying and victimization.

This study, which brings together the research of dozens of scientists, clinicians, child advocates and community groups, will ultimately develop a model that can be used by other communities in Canada to help eradicate this age-old problem.

Dr. Tracy Vaillancourt's research into bullying focuses on community-based prevention.

funding profile

Social Sciences and Humanities Research Council (SSHRC)	$150,393
—SSHRC Community-University Research Alliances	$1 million
Canadian Institutes of Health Research (Co-Investigator)	$269,801
Canada Foundation for Innovation	$150,000
Ontario Innovation Trust	$150,000

NIPISSING
UNIVERSITY

Women Writing on Darwin

He is the biggest of big names in terms of evolutionary theory, but how do women feel about Charles Darwin? That's the question that Dr. Ann-Barbara Graff of Nipissing University's English Department is currently seeking to answer. Her research focuses on contemporary British women's responses to Darwinian evolutionary theory. She is examining how 19th century women co-opted, adapted and rebutted Darwinistic ideas in their fiction and prose non-fiction writings.

The principal outcome of Dr. Graff's research will be a book entitled *Darwin's Sirens: Women Writing Evolution*. The book will challenge conventional assumptions about British liberalism and women's activism. It will explore Darwin's role in silencing sexual politics, contributing to an ideology of childbearing and reflecting race and class prejudices.

Dr. Graff's research interests cross disciplinary as well as international boundaries. She is committed to examining culture historically and to studying cultural forms from a feminist perspective. Her interests lie firmly in what she variously calls "the politics of disenfranchisement." She is fascinated by how marginality is marked and recorded and, conversely, how the legitimacy of political authority is derived and asserted. Dr. Graff looks at social conventions and manners, rhetorical strategies and postures, together with political and scientific discourses to better understand exclusion and inclusion. Her research is interdisciplinary and focuses on the constructions of race, empire and culture.

Dr. Graff also has a conceptual and pragmatic interest in new media. At a recent Association of the Canadian College and University Teachers of English conference in Winnipeg, Dr. Graff presented, in collaboration with Dr. Kathryn Ready, the results of a project using electronic pedagogies in first-year classes as well as in Nipissing University's fourth-year feminist theory class.

Dr. Ann-Barbara Graff is researching how 19th-century British women responded to Darwin's theory of evolution.

funding profile

Social Sciences and Humanities Research Council	$62,550
Nipissing University New Faculty Start-Up Research Grant	$2,487

NIPISSING UNIVERSITY

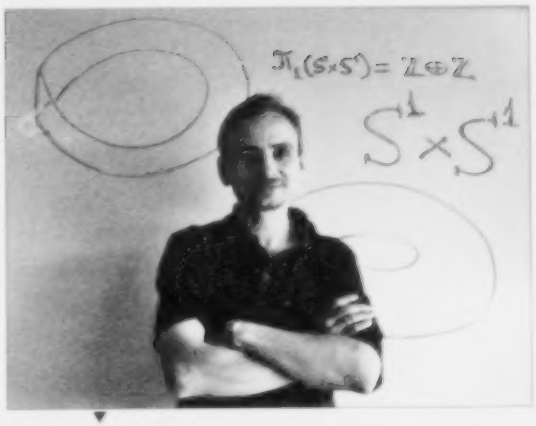
Defining Dimension: Looking Past the Visual to See What Surrounds Us

Most of us take it for granted that we live in a three-dimensional world. Dr. Alex Karassev of the Mathematics and Computer Science Department at Nipissing University would argue that our 3-D assumptions are false. Dr. Karassev is engaged with research in dimension theory—a mathematical theory that examines the spaces we live in and attempts to help understand the dimensions that exist outside the ones we can see.

Is space a rigid entity? How can we be certain that other dimensions exist or do not exist? These are some of the questions that dimension theorists attempt to address.

Theoretically, there are more dimensions than the three that we occupy. Dimension theory states that the dimension of a point is zero, the dimension of a line or a circle is one, and the dimension of a plane or sphere is two. We can move forward or backward, left to right, or up or down. Nevertheless, when mathematicians try to determine the finite number of dimensions in our everyday spaces, the results are not so concrete. The possibility of a number of undetermined dimensions exists, giving way to questions that challenge our conceptions of reality and existence.

Dr. Karassev's research considers the multiple ways of defining the concept of dimension. One of his main goals is to understand how the dimension of an object or a class of objects is related to other important properties of the object and vice-versa. His research allows us to have a stronger awareness of the visible and non-visible spaces that surround us and has applications in a wide variety of areas including physics, economics and biology.



Dr. Alex Karassev is exploring the existence of other dimensions beyond our 3-D assumptions.

funding profile

Science and Engineering Research Canada	$45,000
Nipissing University New Faculty Start-Up Research Grant	$3,000

NIPISSING UNIVERSITY

Building and Growing Community: the History of Northeastern Ontario Communities

Though we all live and work in a community, many of us are oblivious to its foundations and origins. What holds a community together? Is it familial patterns and social networks? How are communities formed? These are questions that Dr. Françoise Noël of Nipissing University's History Department is currently exploring. Her research examines the history of community and family in northeastern Ontario, specifically North Bay and its surrounding areas.

Dr. Noël's research focuses on the period of 1920 to 1960. Her main goal is to determine how northern communities were formed and maintained. She is exploring family rituals, social networks and community involvement in activities such as clubs and sports. Key sources for her project include oral history interviews conducted with local community members. The interviews will contribute to the archives of Nipissing University's new Institute for Community Studies and Oral History, which promotes research and writing on the history of communities in the north.

Dr. Noël's research interest in the North Bay region has also been developed into a new course on Community History which gives her students the opportunity to work on a local history project.

As Chair of the History Department and Director of the new Institute, Dr. Noël keeps busy with a number of projects. One of her current projects involves the establishment of a Family and Community Virtual Archive. She has been collecting photographs, documents and papers from the community and scanning the artifacts into an electric format where they can be easily stored and made available for teaching and research to scholars, students, alumni and the community.

Dr. Noël is also fascinated with historical daily life and culture. Her recent book, *Family Life and Sociability in Upper and Lower Canada, 1780-1870: a view from diaries and family correspondence*, provides a captivating glimpse into the daily life of that time period.

▼ Dr. Françoise Noël is researching the history of community and family in northeastern Ontario from 1920 to 1960.

funding profile

- Social Sciences and Humanities Research Council $40,523

NIPISSING UNIVERSITY

Examining a Historic Travelogue

Dr. Kees Boterbloem of Nipissing University's History Department is currently researching a 17th-century best-seller allegedly penned by Dutch sailor Jan Struys. The best-seller is an account detailing Struys's travels across the Seven Seas, Europe, Asia and Africa. Hired by the tsar, Struys journeyed from Moscow down the Volga River on a ship to trade with Persia across the Caspian Sea. But after a narrow escape from a Cossack uprising, Struys was captured by bandits and enslaved in the Caucasus Mountains. Struys managed to escape his captivity and returned to the Dutch Republic to tell his tale in a book published in Amsterdam in 1676, which was quickly (and often) translated into other western European languages. During his lifetime though, Struys was accused of plagiarism and of fictionalizing many of his stories.

Dr. Boterbloem is investigating both the life of Struys and the story behind his text through research that has taken him to the archives and libraries of Moscow, Washington, Amsterdam and The Hague. He is examining questions of authenticity, identity and the book's reading audience since Struys's travels in themselves and his book's popularity are linked with early globalization. Dr. Boterbloem's research also aims to connect the best-seller and its author to the emergence of the modern citizen within the Dutch Republic.

Dr. Boterbloem's research interests also include the genesis of the modern citizen throughout the Early Modern and Modern Eras and the history of the Soviet Union, particularly its non-existent civil society. His recently published book entitled *The Life and Times of Andrei Zhdanov, 1896-1948* provides new insights into the workings of the Soviet political system and the question of how much power Stalin's lieutenants could exert on their own. Dr. Boterbloem has also charted the suppression of human rights and freedoms by the Soviet dictatorship in his earlier 1999 book, *Life and Death under Stalin: Kalinin Province, 1945-1953.*

Dr. Kees Boterbloem is studying the story behind a 17th-century best-selling book.

funding profile

- Social Sciences and Humanities Research Council $35,650
- Nipissing University Research Council Publication Grant $3,840

NIPISSING UNIVERSITY

Searching for the Fountain of Youth

The genetics and molecular biology of aging are the primary research focus of Dr. Tony Parkes, Assistant Professor of Biology. He is studying how oxygen-free radicals—toxic forms of oxygen generated as a byproduct of normal cellular metabolism—affect aging. Oxygen-free radicals are unstable molecules that can react quickly with other atoms and molecules, causing damage to living tissues. The accumulation of such damage is believed to be the root cause of the aging process leading to specific age-related diseases as well as general functional decline.

Dr. Parkes' research has established that the motorneuron is a life-span-limiting tissue in fruit flies. He has also discovered that a particular enzyme that metabolizes free radicals (SOD1) performs a critical function in protecting this tissue. Overexpressing this enzyme in the motor-neurons of fruit flies increases longevity by 40 percent.

Now Dr. Parkes is asking: How does protecting the motorneuron alone from free radicals extend the lifespan of the entire organism? Is the motorneuron a lifespan-limiting tissue that represents the Achilles heel in aging? Or does it, in some way, regulate the rate of aging in other tissues?

Dr. Parkes is also investigating the various biological functions of oxygen-free radicals by analyzing mutants that lack the SOD1 enzyme. Such mutants have dramatically reduced lifespans and display a complex pathological syndrome reminiscent of many age-related diseases in humans. Each of these disorders serves as a unique window to understanding the roles of free radicals in basic physiology. Ultimately, Dr. Parkes' goal is to define the tissue-specific and physiological basis of each disorder by researching how oxidative stress might interfere with normal cell and tissue function. Using SOD1-mutant fruit flies as a model of chronic oxidative stress will provide clues to the mechanisms of aging and age-related disease in other organisms, including humans.

Dr. Tony Parkes is researching the mechanics of aging and age-related diseases.

funding profile

◗ Science and Engineering Research Canada	$63,500
◗ Canada Foundation for Innovation Ontario Innovation Trust Ministry of Economic Development and Trade	$187,768

NIPISSING UNIVERSITY

How Heavy Metal Affects Ecosystem Health

Biology Professor Greg Pyle's research into the effects of metal pollution on aquatic animals has wide-ranging implications for ecosystem health and industries such as industrial waste management and tourism. His research project, entitled Ecological Consequences of Metal Pollution on Chemical Communication Systems of Aquatic Animals, examines this topic from two perspectives. One explores the basic biology of how fish and aquatic invertebrates communicate by releasing chemical signals into the water and convey important information such as the location of predators or the sexual status of potential mates. The other explores how water-borne metal contamination affects the reception of these signals.

When a metal pollutant is introduced into the water, it can block an animal's ability to read these chemical messages, causing greater susceptibility to predators and more trouble in locating potential mates and food sources. Dr. Pyle's work shows that metal contamination at levels measured in natural systems is not high enough to cause acute toxicity, but is high enough to cause impairment of chemical communication. This can make the invertebrates that fish eat more susceptible to predators, and therefore a depleted food source for fish.

Nipissing University is building a new biology laboratory to house a range of leading-edge analytical equipment for collecting, measuring and characterizing chemical signals. Nipissing hopes that this new facility will establish the university as a scientific hub for chemosensory research in northeastern Ontario.

For Dr. Pyle's students, the new lab and his research offer many opportunities for performing high-level research. A total of 15 students, including both undergraduate and graduate students, are working on research projects ranging from an examination of the chemical secretions male fish use to determine their own progeny to the effects metal contaminants have on olfactory system development in fish embryos.

Dr. Greg Pyle is investigating how metal contaminants affect aquatic life.

funding profile

Science and Engineering Research Canada	$13,000
Canada Foundation for Innovation/ Ontario Innovation Trust	$418,203
Metals in the Human Environment Research Network (with Dr. Chris Wood, McMaster University)	$40,000

Seeking Solutions to Our Gasoline Addiction

Dr. Ibrahim Dincer hopes one day he can help North Americans break—or at least reduce—their gasoline habit. A **Premier's Research Excellence Award** winner, Dr. Dincer has built an international reputation for his research into the practical application of fuel-cell technology in automobiles.

"The concentration of vehicles in urban areas has made air pollution a key environmental issue," says Dr. Dincer. "Fuel-cell vehicles appear to be a major option to overcome the issues of environmental degradation and energy security."

Fuel cells produce electricity by converting the chemical energy of fuel—hydrogen, for example—directly to power in a controlled chemical reaction with oxygen. Because there is no need for combustion or moving parts, fuel cells are ultra clean, highly efficient and very reliable.

Dr. Dincer is recruiting a team of highly qualified personnel to assist in his current research project entitled Assessing and Improving Fuel-Cell Vehicles Through Sustainability, Thermodynamic, Environmental and Life Cycle Analyses. This project will assess fuel-cell vehicles as a viable option to automobiles powered by fossil fuels, and examine the technological challenge, environmental impact and economic implications of fuel-cell technology.

"Research in fuel cells as an alternative means to power vehicles is very important to Ontario and indeed Canada," says Dr. Kamiel Gabriel, the university's Associate Provost, Research and Graduate Programs. "With the escalating price of fossil fuel, coupled with its vulnerability to ups and downs on the global political scene, fuel cells present a clean and viable solution."

Dr. Ibraham Dincer's research into fuel-cell technology promises to benefit consumers, the environment and the economy.

funding profile

Science and Engineering Research Canada	$131,850
AUTO21 (Networks of Centres of Excellence)	$666,700
Premier's Research Excellence Award*	$150,000

* Two-thirds of each PREA is funded by the province and one-third is provided by the university

University of Ontario
INSTITUTE OF TECHNOLOGY

UOIT Researcher Helps Close the Digital Divide

In a world that revolves around instant information, those without access can quickly be left behind. Dr. Ali Grami at the University of Ontario Institute of Technology (UOIT) is helping to ensure that we all live in a digital democracy.

Dr. Grami played a critical role in designing the Ka-band payload carried on Telesat Canada's Anik F2, one of the largest and most powerful communications satellites in the world. Launched from French Guyana last July using Europe's Ariane 5G+ rocket, the broadband satellite is capable of delivering multimedia services such as high-speed Internet, telemedicine, distance education, telecommuting and e-commerce. Telesat's Anik F2 made history as the first satellite to fully commercialize the Ka frequency band—a breakthrough satellite-communications technology for delivering cost-effective, two-way broadband services. Dr. Grami was the lead researcher and principal designer for this broadband payload.

"It will allow Telesat to offer high-speed, two-way communication links by satellite, using small, affordable satellite dishes," says Dr. Grami, a former senior advanced systems specialist at Telesat Canada and now an associate professor in UOIT's Faculty of Engineering and Applied Science and its Faculty of Business and Information Technology.

Telecommunications experts estimate that 15 to 20 percent of Canadian households will never have access to high-speed Internet service through land-based DSL connections, cable modems or fixed wireless networks. In the 1997 speech from the throne, the federal government made a commitment to make Canada the most "connected" nation in the world by delivering broadband Internet access to Canadians from coast to coast to coast. To help reach that goal, Telesat Canada designed Anik F2, which is uniquely qualified to provide broadband services to areas not served or under-served by land-based networks.

"He's an outstanding engineer who was truly instrumental in its design," says Ken Gordon, Director of Telesat's Broadband Technology Development Division. "He planned and designed what we needed."

Dr. Ali Grami is helping to ensure digital democracy with his research.

funding profile

- Science and Engineering Research Canada $100,000

University of Ontario
INSTITUTE OF TECHNOLOGY

Canada's Clean Water Warrior

Think pollution and most people picture factories belching black smoke or dumping chemicals by the boatload. But Dr. Douglas Holdway, Science Professor at the University of Ontario Institute of Technology (UOIT), knows that environmental villains can take more subtle forms.

Last year named as a **Canada Research Chair** in Aquatic Toxicology, Dr. Holdway studies the impact that very brief—or "pulse"—exposure to toxic compounds has on aquatic life. While some scientists study the impact of contaminants such as pesticides, oil spills and toxic chemicals over days or weeks, Dr. Holdway looks at the effects they have on aquatic life in mere hours or minutes.

Studying pulse exposure is a challenging process because relatively little research has been done, and some chemicals leave virtually no detectible trace in fish, animals or water. Current methods of monitoring water quality fail to account for the impact of pulse exposures.

Dr. Douglas Holdway is researching the effect that brief contaminant exposure has on aquatic life.

Dr. Holdway is exploring the use of rapid biomarkers at the individual and molecular levels, and is working on developing "real-time" biosensors to detect contaminants such as fecal coliform and Giardia. These rapid real-time sensors could be invaluable as metabolic markers of natural and drinking water pollution. His research could also contribute to the reassessment of current environmental regulations concerning chemical usage and land-use practices involving agricultural and urban development.

"Professor Holdway's research will provide environmental managers with a better set of tools to mitigate the impact of contaminants," said Kamiel Gabriel, UOIT's Associate Provost, Research and Graduate Programs. "It's of great importance to Ontario and Canada."

Besides working as a university professor and researcher, Dr. Holdway has served as a consultant to governments and private companies. He has occasionally provoked corporate clients with controversial findings, or turned down lucrative contracts if he believed that the projects were hazardous to the environment. He has also helped community groups prepare their cases against proposals he determined to be harmful to ecosystems.

funding profile

Canada Research Chair	$1.4 million
Science and Engineering Research Canada	$75,618
Canada Foundation for Innovation	$125,000
Province of Ontario	$125,000

University of Ontario
INSTITUTE OF TECHNOLOGY

Unlocking the Healing Powers of Food

Dr. Julia Green-Johnson has an abiding passion for bacteria. While many Canadians might cringe at the thought, the Science Professor at the University of Ontario Institute of Technology knows that microbes can be our friends—especially when we eat them.

Dr. Green-Johnson has spent most of her research career looking at the connections between the brain and the immune system, and particularly how certain foods can bolster the body's ability to resist or fight illness. "These functional foods are getting a tremendous amount of attention from the food industry now," says the native of rural Saskatchewan. "There's a lot of interest in what people can do for themselves through their diet."

For Dr. Green-Johnson and her research collaborator, Dr. Claude Champagne of Agriculture and Agri-Food Canada in St. Hyacinthe, Que., the real mystery lies in how bacteria from certain foods interact with microbes in the lining of the intestinal tract to strengthen the immune system. The intestinal cells, she says, are "sentinels of the immune system."

In part, the dietary duo's work involves identifying the specific components in functional foods that produce health benefits. These elements are known as nutraceuticals, and include healthy bacteria, or probiotics, which can be increased by fermenting certain foods. "There's a huge area of diet and food interaction that scientists haven't even touched yet," says Dr. Green-Johnson.

Now, with funding from the Ontario Ministry of Food and Agriculture, the two researchers are looking at the potential nutraceutical and functional food benefits of fermented soy milks. Researchers have already linked soy milk to a reduced risk of cardiovascular disease, and producers in the United States are allowed to advertise that fact on their labelling. "For us, the ideal goal would be a fermented soy product that has some functional food benefit," says Dr. Green-Johnson. "We'd also like to find out what's responsible for the immunological activity. What is it?"

The result will likely be somewhere between a drink and a yogurt product, and contain probiotic bacteria. "And it has to taste good," says Dr. Green-Johnson. "After all, the study is partly aimed at increasing the market for Ontario soy products, which are becoming more popular by the year because of their health benefits."

Dr. Julia Green-Johnson is researching the ability of certain foods to boost the immune system.

funding profile

Science and Engineering Research Canada	$125,000
Ontario Ministry of Agriculture and Food and partners	$228,000
Atlantic Innovation Fund and partners	$194,400

University of Ontario
INSTITUTE OF TECHNOLOGY

A Commitment to Healthy Communities

No one could accuse Carolyn Byrne of hiding away in her ivory tower. As the energetic Dean of Health Sciences at the University of Ontario Institute of Technology (UOIT), she is moving fast to forge research partnerships with health care agencies throughout the surrounding communities of Durham Region and Northumberland County.

Dr. Byrne joined Ontario's newest university in 2002 after a distinguished, 20-year career at McMaster University. Within months of her arrival at UOIT, she initiated an online survey of local health care organizations and called two community meetings to establish research priorities for the faculty. "We had 60 agencies show up," she recalls. "It was just incredible. They're very keen to participate."

To meet the community's most pressing needs, the Faculty of Health Sciences is emphasizing research into the care of the frail elderly, mental health, primary care, and poverty and homelessness. Dr. Byrne is currently involved in a study with the Durham Branch of the Canadian Mental Health Association comparing patients who receive brief, solution-focused therapy alone with those who receive therapy combined with support from their family doctors. The project is designed to test the theory that mental health services produce better results for patients and are more cost-effective when they work in partnership with primary care providers.

In another project, currently at the proposal stage, UOIT plans to team up with five community health agencies to study the care of frail elderly patients living in rural areas. In the town of Beaverton, on the shores of Lake Simcoe, half of the roughly 10,000 patients of a local medical clinic are frail elderly, aged 65 or more with at least two medical conditions. UOIT researchers hope to compare patients receiving care from their family doctors alone with those who are being looked after by a family doctor and a geriatric nurse practitioner who, using telehealth technology, can link patients to geriatricians in urban centres for assessments.

"Being in a university can be isolating, so community partnerships provide me and the rest of the faculty with an understanding of the real issues facing health care," says Dr. Byrne. "We learn from each other."

Dr. Carolyn Byrne's research initiatives into community health are based on collaborative partnerships

funding profile

Ontario Ministry of Health	$184,600
The Ontario Trillium Foundation (through partners)	$50,000
The Change Foundation (Ontario Hospital Association)	$1,800

uOttawa

L'Université canadienne
Canada's university

Building Better Vision

When Dr. May Griffith set out to improve techniques for laser eye surgery a decade ago, she had trouble obtaining the tissue samples she needed. She discovered a way to produce these tissues in the laboratory, and so moved to the forefront of more ambitious efforts to restore the sight of individuals threatened with blindness.

Dr. Griffith, an Associate Professor in the Departments of Cellular and Molecular Medicine and Ophthalmology, constructed a bio-synthetic version of the human cornea—the tough, transparent surface that protects the eye. Her artificial corneas look and behave like the natural ones used in sight-saving transplants. Implanted in the eye, this manufactured alternative functions as a physiological substitute for the cornea, rather than a simple prosthesis.

With extensive professional links across the country, much of Dr. Griffith's work takes place at the University of Ottawa Eye Institute where she also collaborates with members of the Canadian Stem Cell Network. As a senior scientist in the Ottawa Health Research Institute (OHRI), Dr. Griffith also works with OHRI associate scientist Fengfu Li and National Research Council chemist David Carlsson on the development of bio-synthetic corneal replacements for transplantation.

Along with University of Ottawa chemist Deryn Fogg and McMaster University Chemical Engineering Professor Heather Sheardown, Dr. Griffith has obtained project funding from **Science and Engineering Research Canada** and the **Canada Foundation for Innovation**.

▼ Dr. Griffith is advancing research into human vision.

funding profile

Science and Engineering Research Canada	$1.3 million
Canadian Stem Cell Network (Networks of Centres of Excellence)	$200,000
Canada Foundation for Innovation	$623,637
Ontario Innovation Trust	$623,637
Private Sector	$2.5 million

uOttawa

Pondering the Prospects of Privacy and Human Identity

Supported by one of the largest grants ever provided by the **Social Sciences and Humanities Research Council** and several other public and private sector awards, University of Ottawa Law Professor Ian Kerr is leading a number of important research projects that lie at the intersection of ethics, law and technology.

Each of Professor Kerr's projects has been designed to uncover the ethical and legal dimensions of disruptive technologies to propose workable social solutions. As part of this work, Professor Kerr is directing a 23-member team of researchers from the academic, public, private and not-for-profit sector in Europe and North America, representing fields ranging from philosophy, law and government policy to computer engineering, cryptography and cognitive science. Over the next four years, they will design and implement several individual and collaborative multi-disciplinary investigations on the importance and impact of anonymity and authentication in a networked society.

With a collective commitment to the idea that the preservation of anonymity is critical to our social fabric, Dr. Kerr and his team are trying to better understand the impact of information and authentication technologies on our identities, and on our ability to be anonymous.

Professor Kerr is investigating the impact of technology on privacy issues

funding profile

Canada Research Chair	$500,000
Social Sciences and Humanities Research Council	$3 million
Canada Foundation for Innovation	$254,651
Ontario Innovation Trust	$254,651
Private Sector	$500,000

uOttawa

L'Université canadienne
Canada's university

Directing Photonic Traffic

Physics Professor Xiaoyi Bao is literally shedding new light on methods to assess the state of large structures such as dams, tunnels, pipelines or bridges. Dr. Bao is expanding the potential use of fibre optic networks in detectors that can be installed in critical portions of such structures. The scattering of light within these detectors provides an accurate means of measuring temperature, stress and strain, long before these factors result in serious cracks or deformations that could cause a physical failure.

While this kind of detector technology is not new, its application has been limited by the polarization and dispersion of light along fibre optic lines. Dr. Bao has developed techniques that compensate for these effects, permitting high-speed, multi-channel exchanges of data through networks that would otherwise be overwhelmed by this photonic traffic.

Dr. Bao holds a **Canada Research Chair** in Fibre Optics and Photonics. She is also part of the University of Ottawa's Centre for Research in Photonics, a new multidisciplinary facility with 23 researchers from the Faculty of Medicine, the University of Ottawa Eye Institute, the Departments of Physics and Chemistry in the Faculty of Science, and the School of Information Technology and Engineering. In addition to exploring optical instrumentation and sensors, members of the Centre are also studying the use of photonics in biomedicine, communications and other applications.

▼
Through her research into fibre optics, Dr. Bao is discovering new ways to protect the integrity of large physical structures.

funding profile

Canada Research Chair	$1.4 million
Science and Engineering Research Canada & Networks of Centres of Excellence	$1.2 million
National Capital Institute of Telecommunications	$30,000
Canada Foundation for Innovation	$241,178
Ontario Innovation Trust	$241,178
Premier's Research Excellence Award*	$150,000
Photonics Research Ontario & Communications and Information Technology Ontario (Ontario Centres of Excellence)	$200,000
University of Ottawa	$68,816
Private Sector	$51,772

* Two-thirds of each PREA is funded by the province and one-third is provided by the university.

Nutrition for All: Battling Social Inequalities in Health

It is an alarming state of affairs that in countries where food is abundant, not only is obesity on the rise but also the number of families turning to food banks.

"In both developed and developing countries, nutrition is linked with the leading health problems," explains Dr. Lise Dubois, Associate Professor in the Department of Epidemiology and Community Medicine at the University of Ottawa. "And these problems are likely to worsen in the coming years."

Dr. Dubois, who conducted the first nutrition survey on preschool children in Canada, came to the University of Ottawa to accept the **Canada Research Chair** in Nutrition and Population Health. The data she gathered in that survey are now part of an immense knowledge base that she hopes will help to identify the social factors that influence the quality of children's diets and their effect on children's health and obesity.

Dr. Dubois hopes that her research will make it possible to develop policies that will help to reduce health inequalities through changes in diet.

Dr. Lise Dubois is focusing her research on the social factors influencing diet and health.

funding profile

Canada Research Chair	$500,000
Canadian Institutes of Health Research	$155,000
Social Sciences and Humanities Research Council	$443,000
Canada Foundation for Innovation	$124,800
Ontario Innovation Trust	$124,800
IBM	$20,490

uOttawa

L'Université canadienne
Canada's university

Mapping Out Solutions for the Tsunami in South Asia

Support from numerous contributors has enabled University of Ottawa Geography Prof. Michael Sawada to put together a 42 square-metre, state-of-the-art facility—the Laboratory for Applied Geomatics and Geographical Information Systems Science (LAGGISS)—that places the University of Ottawa at the leading edge of geomatics research.

GIS technology allows geographers to interact with researchers in many fields to analyze a wide variety of phenomena from a geographical perspective. Dr. Sawada is using **Canada Foundation for Innovation and Ontario Innovation Trust** funding to apply his research to fields as diverse as climate change, broadband wireless telecommunications, population health and archaeology.

"Geomatics allows us to gather, analyze and interpret various geographic information to help create a detailed and yet understandable picture of the world around us," explains Dr. Sawada. "It helps us to better understand changing patterns of land use, to more effectively manage urban development and our precious natural resources, and improve people's health and living conditions."

Through the capabilities of LAGGISS, Dr. Sawada was able to quickly respond to the tsunami that hit South Asia in December 2004 by mapping the scope of its damage. The lab's disaster-mapping portal—created with the help of private industry partner DM Solutions Group—will continue to help track and co-ordinate relief efforts in the coastal regions of the Indian Ocean.

Dr. Michael Sawada used the leading-edge capabilities of the Laboratory for Applied Geomatics and Geographical Information Systems Science to help in the tsunami disaster.

funding profile

Science and Engineering Research Canada	$64,000
Canada Foundation for Innovation	$124,719
Ontario Innovation Trust	$124,719
Faculty of Arts	$19,486
Private Industry	$347,457

uOttawa

L'Université canadienne
Canada's university

Luminary Chemistry

Dr. Juan Cesar (Tito) Scaiano has spent the last three decades advancing our understanding of the role that light plays in chemical reactions. In doing so, he has earned the respect of the scientific community, nationally and internationally, and received numerous awards along the way, including the prestigious **Gerhard Herzberg Canada Gold Medal** in Science and Engineering in 2002 and, more recently, the **Premier's Platinum Medal for Research Excellence**, one of the largest single research awards in the world. "It's a tremendous honour for me to have been selected," says Dr. Scaiano, a **Canada Research Chair** in Photochemistry.

Widely viewed as the global dean of photochemistry for having pioneered new ways that light can be used to study organic reactions, Dr. Scaiano's current research interests include laser-induced photochemistry, organic photochemistry and antioxidants. Actively pursuing a variety of applications for his findings, Dr. Scaiano sees his research having an impact on health-related areas such as sunscreens and DNA repair, and even on industrial concerns such as the yellowing of paper in the pulp and paper industry.

Dr. Scaiano is donating $250,000 from his Premier's Platinum Medal for Research Excellence Award to create an endowment fund for Faculty of Science students working on their PhDs.

"I wanted it to have a lasting effect and share it with the University of Ottawa and its surrounding community."

Dr. Tito Scaiano has pioneered new ways to use light as a research tool in chemistry.

funding profile

Canada Research Chair	$1.4 million
Science and Engineering Research Canada (NSERC)	$1.8 million
—NSERC Herzberg Medal	$250,000
Canada Foundation for Innovation	$197,861
Ontario Innovation Trust	$197,861
Premier's Platinum Medal for Research Excellence	$1 million
Premier's Research Excellence Award*	$150,000
Others	$1.7 million

* Two-thirds of each PREA is funded by the province and one-third is provided by the university

Queen's University

New Direction for Spinal Cord Research

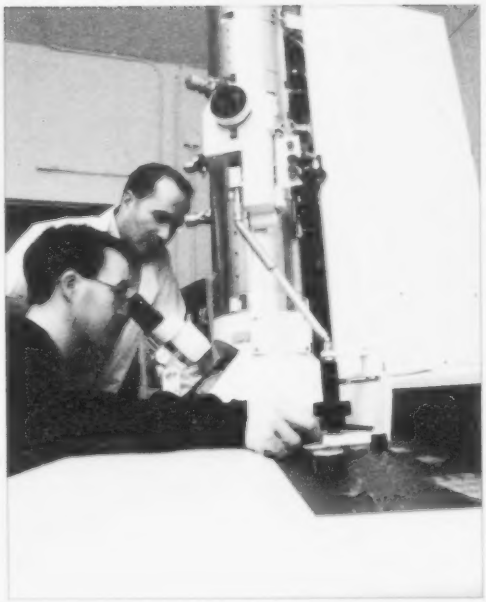
Spinal cord research will likely take an unexpected shift in direction as the result of recent findings by Queen's scientists. Professor Michael Kawaja and postdoctoral fellow Gordon Boyd have discovered that cells earlier identified as key to the development of therapies for spinal cord injury actually fulfill a very different role.

Olfactory ensheathing cells (OECs) are special cells of the nasal system that enhance the continual re-growth of neurons (cells that conduct nerve impulses). The olfactory nerve is the only area in the nervous system where neurons regenerate—a phenomenon experienced by former smokers who find they have recovered their sense of smell after quitting the habit. This phenomenon has led researchers to experiment over the past decade with OECs as a means to promote healing in damaged spinal cords.

Working with colleagues at the University of Saskatchewan, the Queen's team has discovered that OECs are not directly responsible for healing damaged fibres. Another type of "invading" cell, normally found outside the spinal cord, migrates into the damaged cord with the help of OECs. These invading cells are now believed to be the ones with healing properties.

"In light of this new evidence, the research community needs to re-analyze existing data and consider how to proceed in clinical trials," says Dr. Kawaja. "But people living with spinal cord injury can still be excited by the fact that these cells offer a great deal of hope for new therapies down the road."

▼ Recent findings by Dr. Michael Kawaja and Dr. Gordon Boyd hold promise for people with spinal cord injuries.



funding profile

◗ Canadian Neurotrauma Research Program	$74,563
◗ Premier's Research Excellence Award*	$149,000
◗ Ontario Neurotrauma Foundation	$26,950
◗ The Botterell Foundation (Queen's University)	$10,000

* $99,000 is funded by the province; the remainder provided by the university.

Queen's University

Student's Nano Discovery Could Boost Semiconductor Industry

Surprising findings from a PhD project on nanoscale structures may lead to new methods for preparing high quality silicon surfaces for semiconductor device applications.

Queen's University student Jen MacLeod made her discovery while studying the electronic properties of nanolines (lines of atoms) "growing" on the same type of silicon surfaces as those used in microprocessors. It is expected that nanolines will eventually be used as interconnects in microchips.

When she set her microscope to a slightly larger scale—still only 1/1000 of a millimetre—she discovered that the introduction of nanolines had changed the structure of the silicon surface. "This demonstrates that it is possible to control the large-scale structure of surfaces using nanoscale features" says MacLeod, who is conducting the research under the supervision of Prof. Alastair McLean.

Unlike the "top-down" methodology used in current microtechnology applications, nanolines are "grown" by depositing a semi-metallic element to a silicon surface. "When you build from the bottom up, it's much easier to create atomically precise structures," the PhD student explains.

"This discovery leads directly to new methods for preparing semiconductor surfaces," notes Professor McLean. The possibility for innovation has already been recognized by industry. A recent article in Ottawa-based *Silicon Valley North* magazine quotes Dick James, senior technical analyst with engineering services firm Chipworks: "Someone in one of the larger field labs—say an IBM or Intel—may take this research and apply it towards manipulating other material with the same techniques."

Physics PhD student Jen MacLeod prepares samples of nanolines using the scanning tunneling microscope system that she helped to design and build.

funding profile

- Science and Engineering Research Canada
  - — Discovery Grant $208,000
  - — Equipment Grant $195,297

Queen's UNIVERSITY

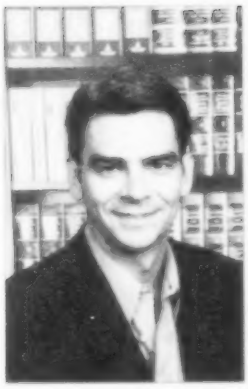
Surveillance Post-9/11

Despite public fears about expanded police and government surveillance powers, research by Queen's Law Professor Arthur Cockfield shows that Canadian enforcement agencies have not significantly increased their surveillance activities since 9/11.

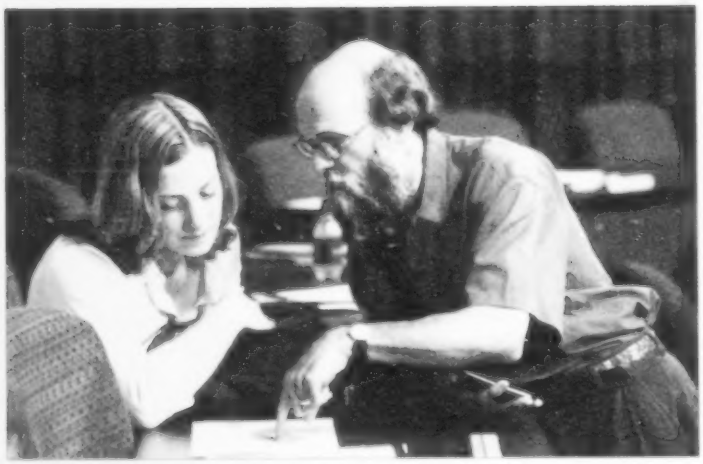
"Changes to Canadian privacy laws have made it easier for the police to spy on us, but these new laws have not, in fact, significantly changed police surveillance techniques," says Dr. Cockfield. But he adds that increasingly powerful information-gathering technologies do present a danger that personal information might be misused, calling for greater public accountability for government surveillance practices.

According to Sociology Professor David Lyon, the trend toward increased surveillance is invading the lives of ordinary people. Surveillance leads to computer-coded categorization of groups in ways that tend to reinforce social divisions—raising questions of social justice and democratic participation. Dr. Lyon and his collaborative team of international researchers are working with federal and provincial privacy commissions and other policy and watchdog bodies to investigate the implications of increasing "personal data" flow across borders. Their work covers various areas of contemporary surveillance, including video surveillance in public places, ID cards, location technologies (such as GPS in cellphones), workplace monitoring, airport and airline personal data handling, biometrics and e-commerce.

"Surveillance is not just something done to people by the government or the police; it's also determined by how far the ordinary person is prepared to go along with it," says Dr. Lyon. "Neither complacency nor paranoia is a very useful response. We'd like to generate some informed debate that will lead to increased awareness and positive change."



Law Professor Arthur Cockfield calls for more public accountability for government surveillance practices.



Sociology Professor David Lyon discusses information, privacy and mobile commerce issues with a graduate student from Queen's School of Business.

funding profile

- Social Sciences and Humanities Research Council
  - Professor Lyon — $1.9 million
  - Professor Cockfield — $42,500

Queen's UNIVERSITY

Patching Up the Pipelines

Canada's utilities supply water, gas, electricity and communications to our homes and workplaces and carry storm water and sewage away from these sites, using billions of dollars worth of buried pipelines. But many of the pipelines are over 40 years old, posing serious health and environmental risks. So every year, aging pipes are repaired or replaced costing Canada billions in dollars.

Dr. Ian Moore, **Canada Research Chair** in Infrastructure Engineering, is working to improve guidelines and techniques for the assessment and repair of aging and damaged pipe systems. His research contributes to more reliable and efficient methods for pipe repair, reducing the need for costly and disruptive pipe replacements. These improved methods translate into millions of dollars in annual savings.

Dr. Moore also serves as Executive Director of the joint Queen's-Royal Military College GeoEngineering Centre—one of the world's leading locations for geotechnical and geoenvironmental research. At the Centre—which is also home to a new collaborative graduate program—a research team works to address a broad range of engineering problems and challenges.

There is a great need for civil infrastructure in the developing world; the World Bank estimates that trillions of dollars will be spent in the coming decades to sustain quality of life for a global population that is expected to increase by 2.5 billion people before 2025. With the Queen's-RMC GeoEngineering Centre, Canada is poised to help meet this need.

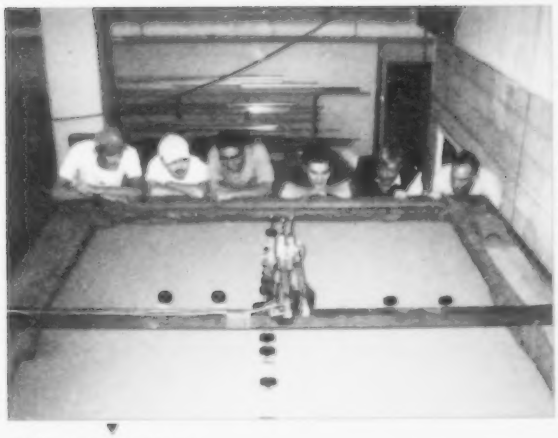


Photo: Dr. Richard Bathurst, co-investigator and joint project supervisor

Dr. Moore (second from right) inspects ground movements with graduate students.

funding profile

Canada Research Chair	$1.4 million
Science and Engineering Research Canada	$1.2 million
Canada Foundation for Innovation	$1.1 million
Ontario Innovation Trust	$1.1 million
Canada Council Killam Foundation	$106,000
City of Hamilton, Ontario	$12,000
National Co-operative Highway Research Program (U.S.)	$200,000
Florida State Department of Transportation	$12,000
James Hardie USA	$160,000
Contech Construction Products Inc.	$15,000

Queen's UNIVERSITY

You May Now Kiss Convention Goodbye

Religious Studies Prof. Pamela Dickey Young examines the social construction of sex and sexuality in relation to Christian religious tradition. Her current research is focused on how Christianity influences public opinion, public policy and law relating to sex and sexuality. This work brings important considerations to contemporary discussions about same-sex marriage.

With same-sex marriage now legal in several Canadian jurisdictions, many are thinking about how the changing definition of marriage will affect society. Professor Dickey Young's research indicates that evolution in the concept of marriage is nothing new. "It is often assumed that the way we see marriage today—as a personal commitment between two people—is the way it has always been," she says. "But that isn't the case." For most of European history, for example, exchange of property and creation of family alliances were among the primary reasons for marriage.

Ecclesiastic involvement in weddings has also evolved over time. "It was not until the 12th century that marriage as a legal function began taking place at the church door, mostly it seems because the priest was the literate person who could make a record of the marriage. And it was well into the 16th century when marriages actually took place inside the church proper and clergy combined civil and religious functions into one service."

In an earlier study on Christianity and divorce, Professor Dickey Young discovered that Canadian churches supported reform of the country's divorce laws back in the 1960s. "What's really interesting is that the churches recognized marriage as an evolving social institution," she says. "They all agreed that, regardless of their own theological views, the country's legislation should reflect the realities of modern life."

Prof. Pamela Dickey Young considers the separation of church and marriage.

funding profile

- Social Sciences and Humanities Research Council $47,549

Queen's University

Mirror Image Molecules

It's a classic Jekyll and Hyde question: how could thalidomide, a drug intended to relieve morning sickness in pregnant women, also be the cause of major birth defects? The answer may be found in chiral chemistry, the study of mirror image molecules.

Enantiomers are matching sets of mirror image molecules. Although they have seemingly identical physical properties, enantiomers are as different as your left and right hands. Because they "grasp" other molecules in different ways, distinct enantiomers can produce radically different outcomes.

Since the thalidomide cases of the 1960s, the field of chiral chemistry has emerged with a wide range of applications. The ability to isolate desirable enantiomers contributes not only to the development of more effective drug therapies with fewer side effects, but also to improved pesticides and herbicides, enhanced flavours and fragrances in food and cosmetics, and even improved liquid crystal display technology.

Queen's Chemistry Prof. Natalie Cann is working with a team of students to develop molecular level descriptions of the structure and properties of chiral molecules. This research may contribute to the development of new approaches to separating desirable enantiomers from those with unwanted or unknown effects.

"Chiral recognition takes place in diverse and complex environments and the recognition process involves more than individual chiral molecules," says Dr. Cann. "To mimic these environments, we model large collections of chiral molecules in liquids and liquid crystals, and on surfaces. The arrangement of the chiral molecules within these dense environments helps us to understand how the mirror image molecules are being distinguished."

Dr. Natalie Cann reflects on mirror image molecules.

funding profile

- Science and Engineering Research Canada $189,200

RYERSON UNIVERSITY

Effects of High G-Force Acceleration on the Human Heart

Dr. Kamran Behdinan, Chair of the Department of Aerospace Engineering and Director of the Ryerson Institute for Aerospace Design and Innovation, is pursuing research in computational mechanics. This field—also known as computer modelling—has implications in fields as diverse as bioengineering, aerospace and automotive engineering, and sports safety.

Fighter pilots experience severe gravitational pressure during periods of intense acceleration. The effect on the heart can be severe. In a study funded by **Science and Engineering Research Canada** and **Defence and Development Canada**, Dr. Behdinan and his team are investigating the effect of high g-forces on the human heart. They have developed a computer model that will ascertain the stress and deformation of the heart under high g-forces. Results of the study will be used to modify the Canadian-designed g-suits used by NATO fighter pilots.

Dr. Behdinan has also created and successfully employed a computational model as a cost-effective tool in the aircraft conceptual and structural design process. The goal is to develop a model that serves as a framework for aircraft structural design. Industry would benefit enormously because designers and engineers would work in a multi-disciplinary manner on aircraft design rather than in individual stages by each discipline.

In addition, Dr. Behdinan supervises more than a dozen graduate students, one of whom, Nicholas Ali, was awarded a Governor General's Gold Medal.

Dr. Kamran Behdinan is focusing his research on computer modelling.

funding profile

Science and Engineering Research Canada	$68,000
National Research Council Canada	$28,175
Automobile of the 21st Century (Networks of Centres of Excellence)	$204,000
Defence and Civil Institute of Environmental Medicine	$158,000
Materials and Manufacturing Ontario (Ontario Centre of Excellence)	$220,140
Pratt & Whitney Canada Corporation	$160,000

RYERSON UNIVERSITY

Manipulating Bacteria and Their Behaviour

Dr. Steven Liss's research into micro-organisms is bringing significant benefits to Canada's wastewater treatment industry.

As Associate Dean of Ryerson's Faculty of Engineering and Applied Science and Professor of Applied Microbiology in the Department of Chemistry and Biology, Dr. Liss has spent years developing techniques that enhance wastewater treatment, environmental control associated with pulp and paper processing, and the quality of well-water systems used in rural and small towns in Ontario.

Dr. Liss, along with his collaborators from the University of Toronto, is leading the world in this exciting field. He hopes his research, which is supported by a team of graduate students, will help to reduce the amount of energy and chemicals used in contemporary wastewater treatment facilities.

Science and Engineering Research Canada has awarded Dr. Liss successive grants to continue his study of bacterial behaviour. Currently, Dr. Liss is involved in a well-water audit with support from the **Ontario Federation of Agriculture**, the **Ontario Centres of Excellence** and the groundwater industry. This audit will investigate the microbiology of well water and the ecology of the well-screen interface.

Recently, Dr. Liss helped **Environment Canada** to organize an international meeting on bioflocculation—a process by which bacteria clump together like a popcorn ball. "We brought in leading experts in flocculation in freshwater, marine and engineered systems." This unique gathering has resulted in a book entitled *Flocculation in Natural and Engineered Systems*, with contributions from scientists from around the world.

Dr. Steven Liss's research into bacteria is bringing improvements to the wastewater treatment industry.

funding profile

Science and Engineering Research Canada	$287,000
Centre for Research in Earth and Space Technology (Ontario Centre of Excellence)	$133,813
Ontario Federation of Agriculture	$24,653
Aquasure Technologies Inc.	$10,000
Aware Environment Inc.	$6,300

RYERSON UNIVERSITY

Ryerson Professor Leads Research on Health Care and Seniors

Dr. Janet Lum, Associate Professor in Ryerson University's Politics Department, is pursuing a range of research initiatives into Canada's ailing health care industry.

One of her latest research projects compares the health, well-being and independence of seniors who live in supportive housing in Toronto with those who live solely on their own. Supported housing offers resources such as meal preparation and housekeeping services to seniors, enabling them to avoid institutionalized housing. "It will be really exciting to be able to show whether there are differences in what we call functional independence, social connectedness, crisis management, physical and mental well-being, in the two populations," she says.

Dr. Lum hopes that results from this study will enable decision-makers to recommend effective policies about supportive housing as an alternative to nursing homes and long-term care facilities.

"The ultimate goal is to give seniors more options and more choice, particularly in their housing options," says Dr. Lum. Affordable housing with health and social supports, as seniors need them, is called 'aging in place.' With the help of community service agencies, seniors can stay in the community, and remain as independent as possible, for as long as possible.

Dr. Janet Lum is working with community and other academic research partners to examine housing options for seniors.

funding profile

- Social Sciences and Humanities Research Council and the University of Toronto (with Dr. Paul Williams) $15,000
- Canadian Institutes of Health Research and the University of Toronto (with Dr. Raisa Deber) $10,500
- Senior Link Neighbourhood Link/United Way $36,500

RYERSON UNIVERSITY

Studying Erosion in a Particular Way

As Associate Professor in Ryerson University's Department of Mechanical and Industrial Engineering, Dr. Marcello Papini is studying methods to erode coatings, remove contaminants and mechanically etch holes and channels in a variety of materials through the impact of directed particles.

"Particle erosion can be used for anything from blast cleaning of industrial equipment and paint stripping from aircraft and automobiles to mechanical etching of glass for opto-electronic and microfluidic applications," explains Dr. Papini.

This research project, funded in part by **Science and Engineering Research Canada** will combine a computer model of the particle erosion process, created by Dr. Papini, with theories of fundamental erosion, some of which Dr. Papini helped to develop. He and his research team, consisting of one doctoral and two master's candidates, may soon be able to select a combination of process parameters to achieve a desired erosion shape, accurate erosion rate predictions, precise abrasive jet machining operations and more efficient blast cleaning.

Currently, many companies rely on the use of chemicals to remove coatings and to etch microscopic features into glass and silicon plates. However, removing coatings with chemicals is messy, costly and harmful to the environment. "We hope that this research will offer a cheaper, faster and more environmentally friendly alternative," says Dr. Papini.

Dr. Marcello Papini is exploring new ways to remove coatings with particle erosion.

funding profile

Science and Engineering Research Canada (NSERC)	$234,190
—NSERC and the University of Toronto	$20,248

RYERSON UNIVERSITY

Malady and Creativity: How Medicine Affects Literature

Dr. Michael Finn, Professor in the Department of French at Ryerson University, is researching the medical community's treatment of women in 1880 French society and how it affected their creativity. With a 2003 Camargo Fellowship award and funding from the **Social Sciences and Humanities Research Council**, his work will be incorporated into a book showcasing the struggle of the creative female in a society dominated by men, where gender roles were strict and well-defined. He will also explore the presence (or non-presence) of spirituality and hypnotism.

A great deal of his research will focus on the French author Rachilde, who suffered a series of mental problems. By examining Rachilde's mental history and how it affected her writing, Dr. Finn will explore the controlling forces that existed for women in 1880s society. His research will be an important contribution to literary, cultural and medical history and will address issues of current debate, including the medical field's effect on people's perceptions of sickness, wellness, creativity and gender roles.

Dr. Finn has recently written two journal articles that will serve as building blocks toward the book. He created the idea for the project two years ago and expects to finish the book in 2007.

Dr. Michael Finn has travelled to Paris as part of his research into 1880 French society.

funding profile

Social Sciences and Humanities Research Council	$36,000

RYERSON UNIVERSITY

Exploring Immigration's Transformation of Canada

Dr. Myer Siemiatycki, Politics Professor and Director of Ryerson University's new Immigration and Settlement Studies graduate program, is co-editing a national study on how immigrants and minority groups in Canada participate in the country's electoral process. With funding from **Geomatics for Informed Decisions** (Networks of Centres of Excellence), Dr. Siemiatycki will address how accessible Canada's institutions are to various racial and ethnic groups. He will also look at the representation of minority and immigrant groups in jurisdictions across all three levels of government.

The research, conducted mainly in Toronto, is the first of its kind in Canada. Because immigration is such an integral aspect of Canadian society, Dr. Siemiatycki's research will provide an important understanding of Canada's identity. His research shows how immigrants create a sense of belonging in a new country and the existing barriers that prevent immigrants from fully integrating into a new society. The project, which is in its preliminary stages, is expected to be complete in 2007.

Dr. Myer Siemiatycki is investigating how immigrants participate in a new society.

funding profile

Geomatics for Informed Decisions (Networks of Centres of Excellence)	$35,000

UNIVERSITY OF TORONTO

Technology for Healthy Soil

University of Toronto at Scarborough researchers Myrna and André Simpson are experts who aren't afraid to get their hands dirty. Using nuclear magnetic resonance (NMR) technology, this dynamic husband-and-wife team is changing the way organic matter is analyzed and revolutionizing the study of the effects of environmental pollutants on soil.

The university's NMR Centre is the first of its kind in the world dedicated to research in environmental chemistry. The lab will be outfitted with state-of-the-art equipment specially designed for separating and analyzing complex mixtures.

"Soil is the world's garbage can," says Myrna. "This technology will allow us to answer fundamental environmental problems."

The NMR spectrometer is similar to the magnetic resonance imaging (MRI) equipment found in hospitals both rely on advanced technology using magnetic fields and radio waves to acquire highly detailed information.

"MRI looks at the human body," says André. "NMR works on a much smaller scale, looking at compounds found in organic matter. By placing samples in a tube and inserting them into the NMR, you can look at soil, leaves, air particles, really anything found in nature. It basically produces a molecular map."

"NMR has been used for decades by chemists for routine analysis of small molecules," explains Myrna. "But it's rarely used to analyze the components of organic matter from various sources within the environment, such as soil, air and/or water."

André notes that most chemical analysis at universities occurs within chemistry departments and typically involves a rapid test. Because soil organic matter is so complex, the NMR tests require at least 24 to 48 hours to produce a variety of information on the structures present in the environment.

"Research is done differently here in Canada," says Myrna. "I think it is a more open, sharing environment geared more toward quality. There are now a lot more programs to support research."

Photo: Ken Jones

▼ Researchers Myrna and André Simpson study the effects of pollution on soil.

funding profile

ANDRÉ SIMPSON	
◗ Science and Engineering Research Canada	$98,000
MYRNA SIMPSON	
◗ Sciences and Engineering Research Canada	$78,000
◗ Canadian Foundation for Climate and Atmospheric Sciences	$203,300
◗ Canada Foundation for Innovation	$300,000
◗ Ontario Innovation Trust	$300,000
◗ Premier's Research Excellence Award*	$150,000

* Two-thirds of each PREA is funded by the province and one-third is provided by the university.

UNIVERSITY OF TORONTO

Preserving Indigenous Languages

Many of North America's indigenous communities are working to preserve traditional languages and pass them on to younger generations. Keren Rice, Professor of Linguistics, is furthering this cause by documenting Slave, an Athapaskan language of the Mackenzie River Valley.

The Athapaskan family is one of the largest groups of indigenous languages in North America and is spoken in many parts of western and northern Canada, as well as in the southwest and Pacific coast areas of the United States. While the languages are known for their complex verb structures and share many similarities in sound systems, morphology (word forms), syntax (word order) and vocabulary, each language possesses its own individual properties.

Professor Rice, who is also the Director of the Aboriginal Studies program at the University of Toronto, is contributing to the future sustainability of indigenous languages by working with a team to compile a dictionary of Slave. She is also revising her 1989 book, *Slave Grammar*, as part of a project to put the grammar of aboriginal languages on compact disc.

In addition to her documentation work, Professor Rice is developing comparative grammar of Athapaskan languages. Through her research, she hopes to develop a better understanding of the system that underlies both the uniformity and the diversity of the languages.

"Many indigenous communities are concerned about language loss and the loss of other cultural materials such as stories and histories that are not passed on into English. Language documentation, in the form of grammar, dictionaries and collections of texts of all sorts, feeds into language revitalization efforts."

▼ Prof. Keren Rice is researching the future sustainability of aboriginal languages.

Photo: Pascal Paquette

funding profile

◗ Canada Research Chair	$1.4 million

UNIVERSITY OF TORONTO

Photo: Pascal Paquette

Dr. Alex Jadad is working to make health care information and services more accessible.

Bringing the Health System into the Information Age

In 1982, as a third-year medical student in Bogota, Colombia, Alex Jadad had a life-changing experience. Asked to speak with children about health, he found that they wanted to talk about narcotics. "I was horrified to realize how little I knew. Here were kids in the second and third grades who knew more than I did."

Basuco, which we now know as crack, was of particular interest to the children. "Even at my medical school, nobody knew much about it. And this was in Colombia, which was already a world leader in the illegal drug trade. There was a mammoth gap between what the public wanted and what we as health professionals were learning and doing," he says. "That gap, which is still present today, has bothered me ever since.

"The health system has been slow to react to the information age. We need to accelerate its transformation so that people can access the information and services they need, regardless of who or where they are."

To accomplish this, Dr. Jadad—who has twice been recognized by *Time* magazine as one of the country's top young innovators—has established the Centre for Global eHealth Innovation, a joint project between the University of Toronto and the University Health Network. The Centre aims to improve health for all through information and communication technologies. Since his arrival at U of T, Dr. Jadad has raised over $15 million in research funding for projects on eHealth innovation.

Dr. Jadad has brought together a team of experts in social sciences, information technology, engineering and health sciences to explore the impact of the web, virtual reality, portable and wearable computers, telemedicine, eLearning, integrated information systems, global collaboration and new methods to study eHealth innovations.

But Dr. Jadad's work isn't only concerned with the e-side of things. A recognized expert in pain management and palliative care, he holds the U of T Rose Family Chair in Supportive Care, which focuses on how to help people meet their most important needs throughout the health care spectrum, particularly when they face stressful situations. "This is what we're trying to achieve with our research—to combine the high tech with the high touch to help people live the healthiest possible lives. That's the way the health system should be."

funding profile

Canada Research Chair	$1.4 million
Canadian Institutes for Health Research	$4.5 million
Canada Foundation for Innovation	$2.2 million
Ontario Innovation Trust	$2.2 million
Ontario Cancer Research Network	$448,000
Premier's Research Excellence Award*	$150,000

* Two-thirds of each PREA is funded by the province and one-third is provided by the university.

Marianne Douglas: Important Messages in Polar Mud

Marianne Douglas hauls a large instrument out of a box in her University of Toronto office. It doesn't look like much, but this gravity corer produces evidence that shows what is happening to the physical environment of our polar regions.

Dr. Douglas, Associate Professor of Geology, is an international leader in palaeolimnology—the study of ancient lake sediments. Most of her work is focused in Cape Hershel, Ellesmere Island, about 1,300 kilometres from the North Pole. More recently, she has taken her investigation to Antarctica.

When the lakes in Cape Hershel thaw, usually for two months a year, Dr. Douglas and her team sink the gravity corers into the water to collect samples of lake sediment. These samples reflect environmental change to the lake over thousands of years.

Through this research, Dr. Douglas and other scientists have now proven that natural causes, not just human-induced forces, have played a major role in the warming trend in the Arctic over the past 150 years. She has co-authored studies that show that changes started to occur around 1845, probably due to the combined effects of increased concentrations of atmospheric carbon dioxide and decreased volcanic activity as well as increased solar radiation.

But Dr. Douglas is quick to point out that these initial natural causes of Arctic warming do not, by any means, take humans off the hook.

"We humans are speeding up the change and making it worse. Nature will cause any environment to change on its own. But the damage we are doing all over the planet is making the change more profound, and this is nowhere more evident than in the Arctic."

Dr. Marianne Douglas on Ellesmere Island. "Humans are speeding up (environmental) change and making it worse."

funding profile

Science and Engineering Research Canada	$503,021
Indian and Northern Affairs Canada	$38,107
Health Canada	$41,833
Environment Canada	$10,000
Canada Foundation for Innovation	$32,215
Ontario Innovation Trust	$32,215
Premier's Research Excellence Award*	$150,000
Ontario Research and Development Challenge Fund 2	$32,215
Connaught Fund	$6,200
Toronto and Region Conservation	$14,000
J.C. Headwaters	$7,500

* Two-thirds of each PREA is funded by the province and one-third is provided by the university.

UNIVERSITY OF TORONTO

Mastectomies Offer New Hope to High-Risk Women

Women with histories of breast cancer in their families can undergo genetic testing to find out if they are at high risk for developing the disease. Those faced with a high-risk diagnosis are then informed of preventive treatments, the most radical being a mastectomy.

But what are the psychosocial implications of this form of treatment? A recent survey by Dr. Kelly Metcalfe, an Assistant Professor in Nursing who is cross-appointed to the Centre for Research in Women's Health (CRWH), has produced surprising results.

Dr. Metcalfe and colleagues from CRWH and the University of Toronto surveyed 60 women who had preventive double mastectomies between 1991 and 2000. The study (published in the January 2004 issue of *Psycho-Oncology*) revealed that two-thirds of the women said the surgery did not impact negatively on sexual functioning and almost half reported no change in self-esteem. Moreover, almost 30 percent felt their body image improved after the procedure.

"We anticipated body image issues or sexual functioning problems, but we didn't find that at all," says Dr. Metcalfe. "When we looked at quality of life, women who had the surgeries scored higher than the general population."

For the majority of women, reconstructive surgery is performed during the mastectomies, helping to ease their apprehension about their appearance after the operation. And since the surgery is preventive and women have not been diagnosed with cancer, the lymph nodes are left alone and chemotherapy is not administered—so the side effects typical of long-term treatment are not experienced.

Dr. Metcalfe acknowledges, however, that for some women the procedure is too drastic. Through her clinical work, she counsels women and helps them decide on other possible breast cancer prevention treatments—such as taking the drug tamoxifen or having their ovaries removed.

"With genetic testing, we now know how to identify women who are at very high risk. My goal is to help women make an informed decision that will prevent them from getting breast cancer."

Photo: Pascal Paquette

▼ Dr. Kelly Metcalfe's research will help women with breast cancer make an informed decision regarding prevention options.

funding profile

Canadian Institutes for Health Research	$68,758
Canadian Breast Cancer Foundation	$183,168
Connaught Start-up Grant	$10,000

UNIVERSITY OF TORONTO

Redefining Marriage

In 2003, same-sex couples won an important battle in Ontario, gaining the legal right to marry. This ruling continues to ripple across North America—causing an outcry from conservative and religious groups.

Dr. David Rayside, Professor of Political Science and Sexual Diversity Studies, is currently writing a book that includes an examination of the political recognition of same-sex relationships in Canada and the United States.

"In Canada we have a kind of unusual history around this issue," Dr. Rayside observes. "Because same-sex couples have already won most rights and obligations associated with marriage—during the 1990s the law came to view them the same way it views common-law heterosexual couples—marriage emerged as a final, symbolic recognition of equality," he says.

"In the U.S., it's a more uneven story. There has been a dramatic movement toward relationship recognition in Vermont, Massachusetts and California, and some movement in a few other states. But very little change has occurred in federal law, so it doesn't begin to parallel the developments in Canada."

Dr. Rayside's current work, which is a follow-up to his last book, *On the Fringe: Gays and Lesbians in Politics*, involves analyzing case studies illustrating the changes in political response to sexual diversity in North America, and interviewing both activists and experts able to reflect on broader developments.

The research also focuses on parenting and schooling issues. "Same-sex parenting issues overlap a lot with relationship recognition issues," says Dr. Rayside. "In the area of schooling, I'm interested in the extent to which public education has recognized sexual diversity, in support given to students, curricular recognition of diversity and acceptance provided for lesbian, gay, bisexual and transgendered teachers."

Photo: Pascal Paquette

Dr. David Rayside is tracking the political response to sexual diversity.

funding profile

- Social Sciences and Humanities Research Council $38,448

TRENT UNIVERSITY

A Closer Look at Women and Work

Though Dr. Joan Sangster of Trent University's History Department is currently studying the intricacies of women and work from the Second World War to the era of "second wave" feminism in the 1970s, her conclusions will have direct relevance for contemporary organizing by women, in and around workplace issues.

Dr. Sangster is researching a book that will focus on a period when, despite the immediate pressures for women to leave the workforce after Second World War, the percentage of women entering paid labour rose by the 1960s. As well, a fundamental shift occurred in the life cycle of women workers, with paid work far more likely to follow, then accompany marriage and motherhood.

"In this important period, for the first time, paid labour was becoming the norm for most adult Canadian women," says Dr. Sangster.

Her research, Transforming Work: Women Workers, Organizing Strategies and the Law in Post World War Two Canada, examines the ways that working women organized collectively to alter and improve the conditions of their work. Using historical case studies from the 1940s to the 1970s that are interpreted in the context of current feminist theory, Dr. Sangster will explore the range of strategies women used to transform their work lives. These strategies, she says, include such things as organizing into unions; using existing protective legislation; combating and changing discriminatory policies and laws; and drawing on informal, customary workplace practices.

"By analyzing the interplay of gender, class and race relations in this process and by critically examining the successes and failures of the organizing efforts, we will learn much about the ongoing relationship between feminist reform, labour activism and the law in modern Canada."

Dr. Joan Sangster is investigating the evolution of women in the workplace.

funding profile

Social Sciences and Humanities Research Council	$39,000

TRENT UNIVERSITY

Examining Emerging Diseases

In our post-SARS world, an array of questions concerning emerging diseases need to be answered—questions that Dr. Craig Brunetti of Trent University's Department of Biology had been looking to answer long before the deadly outbreak. Among them, where are these new diseases coming from?

Dr. Brunetti discussed the transmission of disease from animals to humans at *SARS: How Do We Protect Ourselves in an Age of Global Epidemics*? Dr. Roberta Bondar, who is the Chancellor of Trent University, hosted the event and an eminent panel of experts. Once a virus is passed from a host to a non-host, such as a human, there is potential for that virus to then be transmitted from human to human. "And then you may have a pandemic or epidemic on your hands," says Dr. Brunetti.

Dr. Brunetti's area of expertise is the biology of viruses that infect humans, in particular members of the poxvirus and herpesvirus family. He specifically studies a group of poxviruses that include a Yaba-like disease virus and Yaba monkey tumor virus that infect primates. This group of viruses has crossed into humans several times, causing outbreaks in Nigeria, and is considered a potential emerging disease.

Dr. Brunetti and his collaborators have sequenced the genome of Yaba monkey tumor virus to gain a greater understanding of it. He is now working to understand how these viruses cause disease by elucidating the mechanisms that these viruses use to evade the immune system and by determining the function of conserved viral genes.

▼ Dr. Craig Brunetti's research into the biology of viruses will help to protect people against emerging diseases.

funding profile

- Science and Engineering Research Canada $173,048
- Canada Foundation for Innovation $3.8 million
- Ontario Innovation Trust $3.6 million

TRENT UNIVERSITY

Understanding Human Behaviour Through Computational Archaeology

Understanding the cultural evolution of the inhabitants of the Aegean between 7,000 and 2,000 BC is the focus of Prof. James Conolly's research as Trent University's **Canada Research Chair** in Archaeological Studies.

This time period starts with the colonization of Crete and the Greek mainland by farmers from the eastern Mediterranean, and extends to the emergence of the first European state-level societies in the Aegean Middle Bronze Age.

"The Aegean Islands are one of the best places in the world to explore issues in long-term human behaviour and ecology," says Professor Conolly. "They have an enviable amount of data compiled over more than a century of archaeological investigation and are the setting for a very dynamic cultural history."

An important aspect of Professor Conolly's research involves using Geographic Information Systems and computer simulation to interpret archaeological data related to human mobility, population history and settlement dynamics. He has recently co-authored a book on the subject, *Geographical Information Systems in Archaeology* (Cambridge University Press), and is in the latter stages of co-editing a major synthesis of early farming in Europe.

Students in Professor Conolly's undergraduate and graduate courses in landscape archaeology and computational anthropology will have the opportunity to participate in his research, which will ultimately contribute to our understanding of Mediterranean prehistory, the history of early agriculture, and the dynamics of cultural evolution.

Prof. James Conolly is using Geographic Information Systems to understand long-term human behaviour

funding profile

Canada Research Chair	$500,000
Social Sciences and Humanities Research Council	$140,000
Canada Foundation for Innovation	$61,226
Ontario Innovation Trust	$61,226

TRENT UNIVERSITY

A Living Research Laboratory

Prof. Marrie Mumford, of Trent's Department of Native Studies, is working to breathe life into the new First Peoples House of Learning performance space. As an array of performances enhance Indigenous cultural connections within Trent's communities and beyond, the performance space has become a living research laboratory for this **Canada Research Chair** in Aboriginal Arts and Literature, and contributor to award-winning film, theatre and music organizations.

Professor Mumford investigates Indigenous performance traditions that enhance and perpetuate Indigenous languages and cultures. Her course on Indigenous theatre examines the works of contemporary native playwrights, actors, writers and directors. Professor Mumford has invited Daystar/Rosalie Jones to offer a new course in Indigenous Contemporary Dance and Repertory, at the undergraduate level.

Performance activities at Trent are grounded in Indigenous cultural values and traditions to ensure an enhanced future for Indigenous peoples. Since summer 2004, the performance space has hosted the Centre for Indigenous Theatre, a unique training program that reflects the cultural and artistic origins of Indigenous peoples, and Spiderwoman Theater, the oldest continually running women's Native theatre company in North America. Events have included *Nishnaal—Aaveg Ngamowanan Indigenous Women's Songs* presented by the Otonaabe Women's Hand Drum, Asani and Spirit Wind; and an Aboriginal Performing Arts Symposium that included Indigenous language and performance specialists.

Tama Huata, founder and artistic director of the Kahurangi Maori Dance Theatre of New Zealand, also visited Trent as its 2005 Ashley Fellow. Mr. Huata brought traditional Maori art forms into university forums through the establishment of a Bachelor of Fine Arts degree program in Maori Performance Arts at Massey University—the first Indigenous performance degree program in the world.

Prof. Marrie Mumford is researching performance traditions that promote Indigenous languages and culture

funding profile

Canada Research Chair	$500,000
Canada Foundation for Innovation	$65,000
Canada Council for the Arts	$14,500
Ontario Arts Council	$10,000

TRENT UNIVERSITY

Exploring the Coincidence of Aesthetic and Political Power

Canada Research Chair in Cultural Studies, Prof. Davide Panagia is looking into what we mean when we say we have a "vision" of how our society should be. Where does this vision come from and how is it formed?

Professor Panagia's research focuses on how the divisions that exist in a political society are partly the result of a partitioning of our perceptual capacities. This means that when we assign a role to a group of people, or decide to fund a particular policy initiative, or even elect a political representative, part of what is involved in all these moments of evaluation is an aesthetic sensibility that informs our political commitments.

"The research my students and I are doing impacts our knowledge of democratic cultures by expanding the possible range of what counts as legitimate or illegitimate political action," says Professor Panagia. As part of the research, his students examine how film, music and television disseminate political ideas about Canadian public culture.

In Trent's Media Research Space, students have the opportunity to, among other things, screen and analyze films, often discussing narrative techniques and how they relate to the multicultural politics of recognition in Canadian society.

Students also consider cases such as the *sans papiers* (without papers) in western democracies, where a group of formerly legal individuals are now "illegal immigrants" because of unjust changes in immigration policies. In this instance, sovereign power—the power of the state—coincides with aesthetic power—the power of the image. "Our research explores the coincidence of aesthetic and political power within the rich theory/culture/politics nexus of democratic systems of government," says Professor Panagia.

▼
Prof. Davide Panagia is researching the coincidence of aesthetic and political power.

funding profile

Canada Research Chair	$500,000
Canada Foundation for Innovation	$75,000

University of Waterloo

Atmospheric Chemistry Experiment Investigates Ozone Depletion

Dr. Peter Bernath is leading a team of international scientists in the Atmospheric Chemistry Experiment (ACE)—an initiative to study the depletion of the ozone layer. With measurements taken from the Canadian SCISAT-1 satellite, the team is studying the Earth's stratosphere and mesosphere to better understand ozone depletion, particularly above Canada and the Arctic region.

"Our atmosphere and climate are changing, and some of these changes are due to human activities," says Dr. Bernath. The team's mission is to improve our understanding of the chemical processes that control the creation and destruction of ozone in the upper atmosphere."

The improved satellite measurements will help policy-makers develop more effective environmental strategies to improve the health of the atmosphere and to limit further ozone depletion.

ACE research is also providing global measurements of all major greenhouse gases including water, carbon dioxide, nitrous oxide and methane. An increase in greenhouse gas is a major cause of global warming.

Dr. Peter Bernath, shown with weather monitoring equipment, leads a team of scientists studying the ozone layer.

funding profile

Science and Engineering Research Canada	$2.1 million
Canadian Space Agency	$2 million
Environment Canada	$100,000
Canada Foundation for Innovation	$547,246
Ontario Innovation Trust	$547,246
Industry	$366,960

University of Waterloo

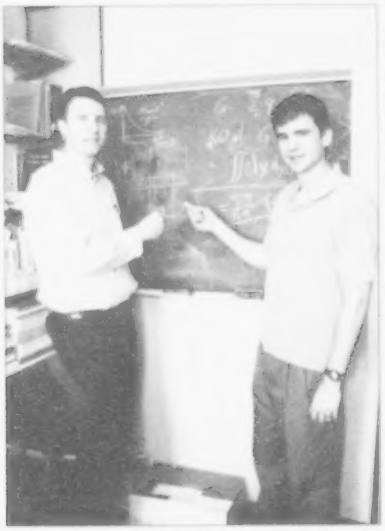
Quantum Gravity Meets Information Technology

Silk fabric looks and feels smooth but, when viewed under the microscope, is really quite structured. Similarly, the fabric of space and time appears to be very smooth and "continuous." This seems to confirm Einstein's general theory of relativity which states that space and time are infinitely smooth, except for the centres of black holes.

Quantum theory, however, has a different viewpoint. Its message is that space and time possess a "discrete" substructure.

These two contradictory views have led to an array of quantum gravity theories in an attempt to solve the true nature of the space-time fabric. But to University of Waterloo's Dr. Achim Kempf, an idea from information technology may provide the answer. This idea can be found in digital audio engineering where the "discrete" and the "continuous" routinely transform into one another.

More information from forthcoming space telescopes may test the notion of a finite "bandwidth" of the universe. Data from these telescopes may be able to confirm the idea that the early universe underwent such an extremely rapid expansion that it stretched the "silk" of the space-time fabric just enough to make finite bandwidth effects visible in the distribution of galaxies in the universe today.



Dr. Achim Kempf (left) of the University of Waterloo discusses quantum gravity with graduate student Rob Martin.

funding profile

Canada Research Chair	$500,000
Science and Engineering Research Canada	$60,000
Canada Foundation for Innovation	$670,264
Ontario Innovation Trust	$515,588
Premier's Research Excellence Award*	$150,000
Industry In-kind	$424,295

* Two-thirds of each PREA is funded by the province and one-third is provided by the university/industry.

University of Waterloo

The Canadian Early Childhood Language Project

Dr. Daniela O'Neill in the University of Waterloo's Psychology Department is heading a research project that will improve the lives of Canadian children.

The Canadian Early Childhood Language Project aims to help health professionals detect early language delay through a specially designed questionnaire. Parents will complete the form to capture milestone developments in their children's language development.

The questionnaire will target children between 18 months to four years of age and will involve 3,000 parents.

Dr. O'Neill and her research team are developing norms or standards of language development for the questionnaire. These standards will enable day care and preschool teachers, health professionals, community outreach workers and researchers to quickly and easily flag early language delays.

"Research has shown that the earlier children receive intervention for language delay, the greater the chances of more rapid and effective improvement in their language proficiency," says Dr. O'Neill.

This is very important because delays in language development can have far-reaching negative effects on children's school performance, socio-emotional development, and interpersonal relationships.

The Canadian Early Childhood Language Project is also a key training opportunity for a new generation of health professionals and researchers. "The majority of students working on this project have pursued or are pursuing postgraduate work in the areas of speech-language pathology, language development or child development," she says.

Dr. Daniela O'Neill of the Psychology Department works with children at the university's Centre for Child Studies.

funding profile

Canadian Institutes of Health Research	$332,656
Science and Engineering Research Canada	$88,000
Premier's Research Excellence Award*	$136,296

* Two-thirds of each PREA is funded by the province and one-third is provided by the university.

University of Waterloo

Metal Forming Research Aids Auto Industry

Much of the highly competitive automobile industry is based on sheet- and tube-metal forming.

Dr. Michael Worswick, Professor in the Department of Mechanical Engineering, is an expert in sheet-metal stamping, hydroforming, impact and crash-worthiness. His research focuses on developing advanced techniques for sheet- and tube-metal forming, as well as the use of new advanced steel and aluminum alloys in traditional stamping and hydroforming processes.

One of his specialties is hydroforming, a relatively new process for the automakers that's edging out older stamping and joining methods. The process uses 30,000 pounds per square inch of water pressure to force steel tubes into two halves of a die to form a structural shape. Stronger than stamped and welded parts, steel tubes are used in vehicle frames, engine cradles and wherever structural strength and stiffness are needed. As well, hydroformed parts are faster to manufacture and offer tremendous savings by consolidating parts.

Techniques such as electromagnetic forming are also being studied, along with the response of lightweight alternatives such as thin-walled, high-strength steel or aluminum tubes, instead of conventional low-strength steels that are more formable but too heavy. The big challenge is that stronger, harder metals are more likely to crack under the stress of hydroforming.

By using physical laboratory tests and computer modelling to show when parts are most likely to fail during hydroforming, research is providing answers about the pre-bending stage. This is an important contribution as industry moves to higher-strength materials with lower formability.

General Motors of Canada, Alcan and Dofasco are also conducting programs to examine the performance of lightweight auto structures under crash conditions. Results from these initiatives will help to ensure that occupant safety is not compromised due to light weighting.

Automotive parts are put into a stamping press by researcher Dr. Michael Worswick.

funding profile

Canada Research Chair	$1.4 million
Science and Engineering Research Canada	$192,520
AUTO21 (Networks of Centres of Excellence)	$187,687
Canada Foundation for Innovation	$127,026
Ministry of Economic Development and Trade	$127,025
Ontario Research and Development Challenge Fund	$3.5 million
Materials and Manufacturing Ontario (Ontario Centre of Excellence)	$518,500
University of Waterloo	$3.8 million
Industry	$4.3 million

University of Waterloo

Ecoplan China Project Helps to Protect Coastal Environment

Dr. Geoffrey Wall, Professor of Geography in the Faculty of Environmental Studies, is directing a multi-year project that will help Chinese coastal communities manage environmental development pressures.

The Eco-Planning and Environmental Management in Coastal Communities of China project—known as Ecoplan China—will enhance human and institutional capacities to design, implement and monitor integrated environmental policies and programs.

Funded by the **Canadian International Development Agency (CIDA)**, Ecoplan China builds on another CIDA-sponsored project—the Canada-China Higher Education Program—that saw Dr. Wall and his colleagues work with other university and government partners on integrated coastal zone management in Hainan, China.

Dr. Wall's research focuses on tourism and recreation as well as the socio-economic implications of global climate change. His projects have included the impact of tourism on host communities; assessments of the greenhouse effect on tourism and recreation; contributions to a sustainable development strategy for Bali, Indonesia; ecotourism in North Sulawesi, Indonesia, and Inner Mongolia, China; co-operative management arrangements for parks and historic sites; and tourism and aboriginal people in Taiwan.

Dr. Wall has also received the Roy Wolfe Award of the Association of American Geographers for his contribution to the understanding of tourism and recreation and the John Rooney Award for outstanding achievement in the field of applied recreation geography.

Dr. Geoffrey Wall *(left)* discusses his work with University of Waterloo President David Johnston at the Dalian University of Technology in China.

funding profile

▸ Canadian International Development Agency	$4 million $1.2 million
▸ Social Sciences and Humanities Research Council	$64,520

University of Waterloo

Research to Prevent Eye and Vision Problems

Dr. Elizabeth Irving of the School of Optometry is focusing her research on the prevention of eye and vision problems and the promotion of vision health.

A **Canada Research Chair** in Vision Science, Dr. Irving is studying the development of refractive and eye movement, with an emphasis on preventing or reversing myopia, or nearsightedness.

Estimates show that myopia is a major health issue, affecting 30 percent of the population in North America and up to 90 percent in Asia, with reported increases in the prevalence and severity of high myopia. In developed countries, it is a leading cause of legal blindness and costs billions of dollars on treatment and on associated conditions such as retinal detachment.

Dr. Irving's research in eye movement deals primarily with children. New non-invasive, video-based eye tracking now allows children's eye movements to be studied in a systematic way. This helps to determine whether movement problems are related to reading and other learning difficulties or are symptoms of neurological problems.

Research funding has enabled Dr. Irving to attract highly skilled graduate students and postdoctoral fellows to assist with further myopia and eye-movement study. Her graduate students include two optometrists from India, an optometrist from Iran and an ophthalmologist from China.

Dr. Elizabeth Irving is holder of the **Canada Research Chair** in Vision Science

funding profile

Canada Research Chair	$500,000
Science and Engineering Research Canada	$135,000
Canada Foundation for Innovation	$66,000
Ontario Innovation Trust	$66,000
Premier's Research Excellence Award*	$150,000

* Two-thirds of each PREA is funded by the province and one-third is provided by the university.

Research Western

Keeping Sweets Away from Stomach Bugs

Prof. Carole Creuzenet, recipient of the **Premier's Research Excellence Award**, hopes to find the keys for neutralizing Helicobacter pylori (H.pylori) and Campylobacter jejuni, two pathogens that lead to gastroenteritis, gastric ulcers, some gastric cancers and other stomach diseases.

Necessitated by resistance to currently employed antibiotics, researchers are seeking to uncover new avenues for treatment by examining the roles played by unique sugars on the virulence (the disease-causing potential) of these bacteria.

Professor Creuzenet hopes to show that these sugars are the link between bacteria and host, thereby providing researchers with a target at which to aim. "Preventing the production of sugars targets various virulence factors and destroys several pathways in the bacteria," she explains. By studying the activity of proteins that produce the sugars, her team can test for compounds that will inhibit or prevent the attachment of the bacteria, or prevent the secretion of virulence factors.

H.pylori is present in the stomachs of two-thirds of the world's population; long-term exposure, even for those who are only carriers of the bacterium, may still lead to significant tissue damage. Recent findings related to genomic data about these pathogens have greatly impacted research in this field, including Professor Creuzenet's discovery of two new genes in H.pylori that lead to the secretion of multiple virulence factors.

This laboratory provides graduate students with the opportunity to further their training in microbiology and biochemistry; however, much of the work is cross-disciplinary, providing students with the opportunity to use cutting-edge technology in their own projects, while learning new disciplines as they progress.

Prof. Carole Creuzenet analyzes the role that specific sugars play in stomach ailments.

funding profile

Canadian Institutes of Health Research	$288,900
Science and Engineering Research Canada	
—University Faculty Award	$120,000
—Joint Award: Canadian Association of Gastroenterology, Abbott Laboratories**	$82,044
Canadian Institutes of Health Research	$90,000
Canada Foundation for Innovation	$226,000
Ontario Innovation Trust	$226,000
Premier's Research Excellence Award*	$150,000
Western Academic Development Fund***	$60,000

* Two-thirds of each PREA is funded by the province and one-third is provided by the university.
** Annually, 2001-04.
***Funding for the purchase of equipment.

Research Western

Statistics Canada Research Centre Allows Access to Social Statistics

Prof. Roderic Beaujot, 2001 winner of the John Porter Memorial Book Prize for best Canadian Sociology book, studies fertility in households, as well as family demographics and the division of labour—including paid and unpaid work.

Under his direction, The University of Western Ontario has introduced a Research Data Centre for accessing data from Statistics Canada. The Centre provides researchers with access to uncensored data sets and promotes training and interest in the analysis of social and health statistics. Western's facility is unique in that it is developing an Internet Data Library System that provides users with easier access to metadata—information about data.

One of 12 in the country, this facility provides a secure environment for researchers and graduate students to conduct analyses of various longitudinal and cross-sectional survey data. To ensure privacy and confidentiality, researchers must demonstrate a valid research need for the data and receive clearance through a peer review conducted by the **Social Sciences and Humanities Research Council**. All data analysis is done within the confines of the Centre.

One of Professor Beaujot's current projects examines the practical matters of trends in fertility. Research has shown, for example, that child-rearing earlier or later in life affects childbirth rates and presents potential health consequences to both parent and child. In terms of both fertility and health, Professor Beaujot seeks to demonstrate how these trends will impact society, notably labour force renewal and the healthcare system. "The goal is not to make policy, but to make information available to policy-makers and decision-makers to improve our society by knowing the consequences."

Prof. Roderic Beaujot is examining the societal impact of fertility trends.

funding profile

Statistics Canada Research Data Centre	
▸ Canada Foundation for Innovation	$127,280
▸ Ontario Innovation Trust	$127,280
▸ Bolen Distributing Incorporated (in kind)	$32,400
Prof. Roderic Beaujot	
▸ Health Canada Health Policy Research Program	$175,700
▸ Social Sciences and Humanities Research Council —Strategic Grant	$62,300 $473,200

Big Thoughts on the (very) Small Scale

Prof. Ian Mitchell has big goals for work that can be measured on the nanoscale, or one billionth of a metre. With funding from the **Canada Foundation for Innovation**, **Ontario Innovation Trust**, **Science and Engineering Research Canada** and the **Ontario Research and Development Challenge Fund**, as well as donations of equipment from Nortel Networks, The University of Western Ontario has built a leading nanofabrication laboratory that is unique in Canada.

The facility's cutting-edge research focuses on photonics, or the harnessing of light. Sophisticated new lithographic tools, including a focused ion beam, allow for pattern and feature definition of materials at dimensions below the wavelength of light.

Many fields stand to benefit from this work, including the information technology sector, where nanofabrication may lead to smaller photonic components, lower power usage and greater bandwidth. "We want to go where none of us—not the researchers, not the Faculty of Science, not the university—have gone before," says Professor Mitchell.

Western, McMaster and Waterloo have formed the Ontario Photonics Consortium to bring their diverse strengths to this cutting-edge research —strengthening collaborative ties in the process. Having this first-rate nanofabrication laboratory also provides graduate students with a great opportunity to further their research in nanoscience.

The facility's activities are already reaching into other domains, including earth sciences where the technology can be used to cut earth particles, and in engineering for the construction of electronic circuitry. "This is unfamiliar research, which makes it intrinsically exciting," says Professor Mitchell.

Professor Emeritus Ian Mitchell is hoping to make advances in photonics through nanofabrication.

funding profile

Nanofabrication Laboratory	
◗ Canada Foundation for Innovation	$3 million
◗ Ontario Innovation Trust	$3 million
◗ Ontario Research and Development Challenge Fund	$5.2 million
Prof. Ian Mitchell	
◗ Science and Engineering Research Canada*	$142,600

* Continuing annually through 2006.

Western

Bridging the Gap in the Fight Against Breast Cancer

By maintaining communication between cells, scientists hope to make gains in breast cancer research.

Prof. Dale Laird, of Western's Department of Anatomy and Cell Biology and Department of Physiology and Pharmacology, is exploring the role of gap junctions in disease. Gap junctions are membrane channels composed of proteins called connexins that allow cells within tissues to communicate with each other. When they do not exist, or are otherwise mutated, cells are unable to communicate properly, which often leads to the onset and spread of disease.

By reintroducing connexins into tumor cells, Professor Laird hopes to reduce the spread and growth of tumors. Gap junctions may also eventually be used to deliver drugs directly to a tumor's mass. "This will not be a curative solution, but hopefully a piece of a larger puzzle," Professor Laird says.

About one-third of Professor Laird's laboratory focuses on the role of gap junctions in breast cancer. His research in this area has opened avenues of study into other diseases linked to connexin mutations, including developmental disorders and deafness. "It is comforting to know that findings from our cancer research studies may also be important in other human diseases," he says.

The research group also hopes to better understand the mechanisms of tumor suppression. "Is it the cell-to-cell exchange of signals, or is it how a connexin binds to other important molecules within the cell? We know that there are small molecules signaling from one cell to another, but we don't know which ones are important—that's the black box of our work," says Professor Laird.

Prof. Dale Laird is researching how cells communicate with one another.

funding profile

Canada Research Chair	$1.4 million
Canadian Institutes of Health Research	$224,145
Canadian Breast Cancer Research Alliance	$154,250

Western

Prof. Hugo de Lasa's research will help industry develop environmentally friendly processes and products.

A Catalyst for Environmental Reform

Prof. Hugo de Lasa's research is fueled by the desire to help companies around the world respond to stricter environmental guidelines.

Professor de Lasa is a Chemical and Biochemical Engineering Professor and the Director of Western's Chemical Reactor Engineering Centre (CREC), which he founded in 1986. CREC is a research and consulting laboratory that develops new reactor technologies in close collaboration with the industrial sector. Since its launch, CREC has achieved international recognition as a centre of teaching and research expertise in chemical reactor technologies.

"The CREC Riser Simulator provides a window of opportunity for conceptualizing and developing new catalysts," says Professor de Lasa. "These catalysts may become the critical ingredient of urgently needed environmentally friendly chemical processes." With the simulator, new catalysts can be developed for the cracking and reforming of diverse hydrocarbon feed stocks, which are major industrial steps for the manufacture of clean fuels.

Ten CREC Riser Simulators are in use across the world today. Universities, research centres and a number of major industrial corporations are using them to test environmentally friendly processes and products. "These innovations will play a fundamental role in the improvement and advancement of industrial processes for the production of clean fuels, such as hydrogen and reformulated gasoline, free of sulphur and carcinogenic chemicals," says Professor de Lasa.

Over the past five years, the simulator has attracted more than $3 million in grants and industrial contracts to Western. Looking ahead, CREC will concentrate on developing new products and processes that will address expected new legislation and environmental regulations.

funding profile

Science and Engineering Research Canada	$44,000

Research Western

Technology Industry Growing Up

Researchers are creating a body of knowledge that will enable information technology (IT) companies to better manage and sustain an aging workforce.

Western Sociology Prof. Julie McMullin leads the Workforce Aging in the New Economy project, an international comparative study of IT employment involving labor groups, technology organizations, IT companies and researchers across the globe.

Despite the industry's massive growth over the past decade, the team has found that IT industries tend to be very small and unstable. In Canada, for example, 96 percent of IT firms employ fewer than 10 people and one-third will close before they are three years old. Small firms often face challenges providing training and benefits for employees, which may create obstacles and hinder employment opportunities for older workers. "Incentives and company policies may need revision to reflect the aging workforce," says Professor McMullin.

To this end, the project—due to wrap-up in the spring of 2007—will look to inform policy at individual, firm and government levels, and to help develop human resources strategies for better managing older workforces. "We are looking to determine best practices to help companies reconcile profitability and employee well-being," she says.

Professor McMullin recently received the largest-ever grant from the **Social Sciences and Humanities Research Council of Canada** as well as a **Premier's Research Excellence Award**. "With these funds, we are able to train graduate students—the bread and butter and true legacy of such a project."

Prof. Julie McMullin is studying the employment practices of the IT industry.

funding profile

Social Sciences and Humanities Research Council	$3 million
Premier's Research Excellence Award*	$150,000

* Two-thirds of each PREA is funded by the province and one-third is provided by the university.

Wilfrid Laurier University

Writing the Book on African Reparations

Human rights researcher, Dr. Rhoda Howard-Hassmann, is writing a series of articles on reparations to Africa. The project will culminate in a book entitled *What the West Owes Africa* that presents her views on distributive and reparative justice.

Dr. Howard-Hassmann will argue that the West is obliged to help African states protect the economic rights—which include the right to health care, education and shelter—of all citizens. Some of this obligation stems from the way the West harmed Africa in the past. "The West needs to acknowledge its own history of racism and pay attention to the consequences for Africa," she explains. "Respect for the moral integrity of Africans needs to be an integral part of any international discussions about reparations."

The project is based, in part, on interviews that Dr. Howard-Hassmann and two research assistants conducted with 76 Africans. These include ambassadors, academics, and human rights activists and policy makers from more than two dozen African countries.

The research is internationally significant in the context of global terrorism. It's unearthing a sense of tragedy and anger in Africa, and a sentiment among some Africans that they are not being heard. "They are angry because they are poor and they are angry because they think the West is rich because they're poor," she says.

Dr. Howard-Hassmann is also creating a web site database on political apologies and reparations.

Dr. Rhoda Howard-Hassmann is focusing her research on justice for Africa.

funding profile

Canada Research Chair	$1.4 million
Social Sciences and Humanities Research Council	$107,005
—Major Collaborative Research Initiative	$48,308

Wilfrid Laurier University

The Dynamic World of Coupled Systems

Dr. Roderick Melnik perceives the world in two ways: as a series of everyday objects that most people see, but also as as complex systems that are found in things as small and seemingly simple as a leaf or as massive and multifaceted as weather patterns.

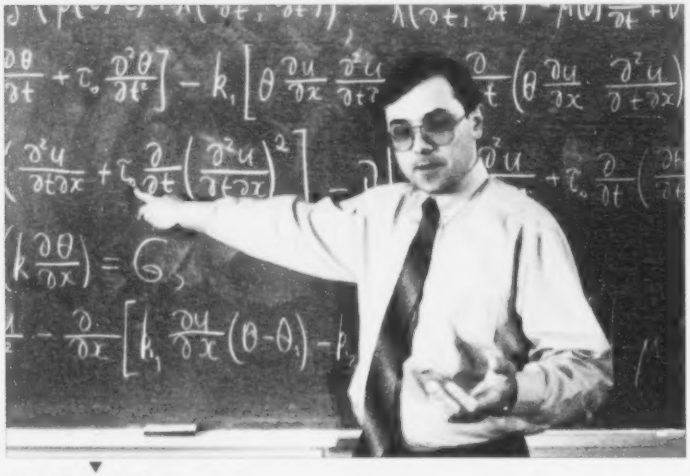
A world expert in applied and computational mathematics, and holder of a new **Canada Research Chair** in Mathematical Modelling, Dr. Melnik is researching new mathematical and computational tools for the analysis of systems and effects that are becoming increasingly important in science and technology. His findings should lead to a broad range of applications, from the design of new devices and systems applied in nanotechnology and biotechnology to applications in aerospace and environmental engineering.

"Most systems that surround us, whether created by nature or by human beings, are coupled in the sense that they consist of components that interact with each other," says Dr. Melnik. "In many cases, such interactions hold the key to a better understanding of system behaviour."

Dr. Melnik seeks to develop constructive mathematical procedures for solving simultaneously the partial differential equations related to coupled processes. These processes are intrinsically dependent on both position and time, and certain elements are sometimes subject to random fluctuations, making them difficult to analyze.

Understanding coupled processes has important implications in such fields as biotechnology and medicine, polymer chemistry and financial engineering, as well as application in optoelectronics and energy-saving technologies. The research spans traditional disciplinary boundaries between mathematics, science and technology.

Dr. Melnik will be establishing a computational science, modelling and visualization lab. The facilities will allow high-end visualization in mathematical modelling of complex nonlinear phenomena.



Dr. Roderick Melnik is investigating new mathematical tools for systems analysis.

funding profile

◗ Canada Research Chair	$1.4 million
◗ Canada Foundation for Innovation	$74,970

Wilfrid Laurier University

The Economic Impact of Family Businesses

Dr. Pramodita Sharma is pioneering a new understanding of the importance of family businesses to national economies. She is currently working on two studies that explore how family businesses are organized and how leadership changes hands within families.

"Family firms are prevalent in nations around the world and play an important role in creating social and economic stability," says Dr. Sharma. "Family businesses possess a unique and winning combination of social, human and financial capital that equips them to foster the economic and social health of nations."

Her first study, conducted with co-researcher Dr. Gregory Irving, is exploring the generational transition of leadership in family businesses. Dr. Sharma is working with the Centre for Family Business in Waterloo Region and, on the national level, the Canadian Association of Family Enterprises.

Her preliminary findings reveal that over half of family firms in Kitchener-Waterloo have either transferred leadership in the last five years or are expecting such transitions in the next five years. However, the study also showed that the firms seemed slow to plan for generational ownership transition.

Dr. Sharma is also investigating the impact of family businesses on the Canadian economy. By examining the corporate governance mechanisms in high performance Canadian family firms, Dr. Sharma will show the level of revenues and employment that family businesses contribute to the Canadian economy.

Dr. Sharma's research should assist family businesses to better understand not only how to manage their organizational structure, but also the mode and extent of family member involvement. Her findings will also be useful in discussing how to best approach public policy regarding family firms.

Dr. Pramodita Sharma is investigating the impact of family-run businesses on the Canadian economy.

funding profile

▸ Social Sciences and Humanities Research Council	$55,100
—Jointly with Dr. Gregory Irving	$58,368

Wilfrid Laurier University

Safeguarding Our Water Supply

By studying metals undetected by the human eye in water, Dr. Scott Smith is gathering information about toxicity and the environment. Ontario's Grand River, where sewage treatment and drinking-water treatment plants coexist, provides a rich environment for his research focus. "It wasn't my intention to work in sewage treatment plants; it's just where to go to answer the problems I want to answer."

A Professor of Chemistry at Wilfrid Laurier University, Dr. Smith focuses on sewage-affected environments because they contain nitrogen. Sewage nitrogen is well established as a nutrient source, but its impact on metals has received less scientific attention. Many metals can bind to nitrogen, so it is important to understand how this relationship will affect the environment.

Dr. Smith determines the amount of toxins in the water by examining how metals are bound to chemicals in sewage. A metal that is not bound to sewage is highly toxic because it can easily make its way into the local drinking water. "You want to determine the toxic form of a metal to avoid negative environmental impacts," he emphasizes.

Dr. Smith hopes that legislation concerning discharge will change to consider how metals react with existing material in that environment, as well as the amount of metal that is discharged. "Environmental concerns have always defined my research goals. My aim—in some small way—is to make the world a better place."

▼ Dr. Scott Smith has developed a new technique called multi-response speciation for application to environmental issues.

funding profile

◗ Science and Engineering Research Canada	
—Discovery Grant	$78,000
—Equipment Grant	$14,807
—CRD Grant	$15,000
◗ Startup funds at WLU	$60,000
◗ EnviroSim Contract	$15,000
	$10,000
◗ Kodak Canada Research Grant	$15,000

Wilfrid Laurier University

Measuring Greenhouse Gas from Wetlands

Geography Prof. Richard Petrone is hoping a new perspective can generate a greater understanding of greenhouse gas emissions—a growing environmental problem. Working with a team of environmental scientists from the University of Alberta, Dr. Petrone is monitoring the impact of human activity on the wetlands of the Canadian Western Boreal Plain.

"The climate is changing and we've already seen a significant impact on temperatures in the north," says Dr. Petrone.

When wetland decomposition occurs naturally, it satisfies the balance of atmospheric elements needed for a comfortable climate. But human activity has accelerated the process, and today natural wetland decomposition is a major contributor to global warming and a growing concern to climate variability. Nowhere is this more of an issue than the Western Boreal Plain, where industrial pressures threaten to potentially augment climate change. Carbon dioxide and water vapour, two of the highest concentrated greenhouse gasses, have reached record levels.

"There's no question that global warming is happening. We also know that it's increasing. We could sit here and debate who's causing that increase, or we can recognize its effect and deal with it."

Dr. Petrone offers a hopeful perspective. "The ultimate goal for my research team is to create tools and guidelines that will help industry prevent further damage to the environment.

Dr. Richard Petrone hopes to alleviate the growing problem of greenhouse gas emissions.

funding profile

- **Science and Engineering Research Canada**
  - —Discovery Grant $55,000
  - —Research Tools and Instrument Grant $72,721
- **Ducks Unlimited & Alberta Pacific Forest Industries Inc.** $15,000
- **Sustainable Forest Management Network** $110,000

Wilfrid Laurier University

Problems that Take Too Much Computer Time

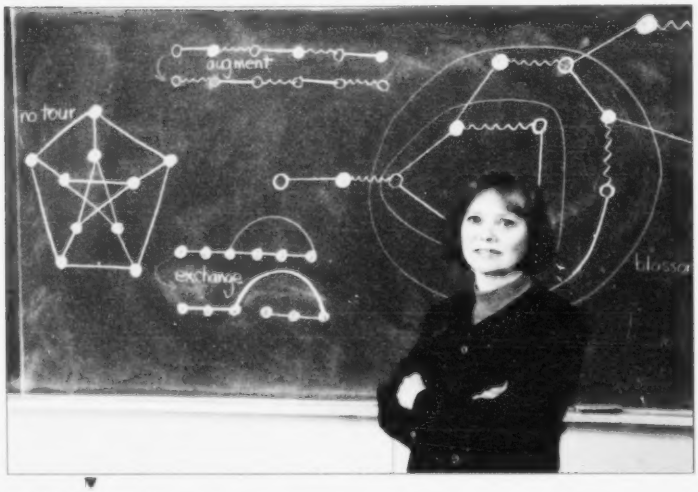
Dr. Kathie Cameron studies math problems that have so many possible answers that no computer can ever be fast enough to decide among the many possibilities. A Mathematics Professor at Wilfrid Laurier University, Dr. Cameron tries to solve such problems by developing theory that can drastically reduce the number of possibilities.

Dr. Cameron's work is in the field of discrete algorithms, a subfield of combinatorial mathematics. There are no traditional laboratories or experiments in her work. Instead, she uses sophisticated mathematical theory to find new methods and prove that they work well.

"Faster computers are not going to put me out of business," explains Dr. Cameron. "Without a better theory, no computer will be able to conquer these types of problems, regardless of its speed." The time it might take a computer using known methods to find a good solution might be centuries, or even millennia.

Although Dr. Cameron's research remains in the theoretical realm, her findings have far-reaching implications in areas such as scheduling and compiler design (computer programs that translate computer languages). One of her favourite examples involves something close to her workplace—the slotting of exams.

"In principle, we could write all the possible exam schedules down to see which ones don't have any conflicts," she explains. "But the number of possible combinations is too huge. We need heavy theory to bypass them."



Dr. Kathie Cameron solves problems beyond the fastest computers.

funding profile

Science and Engineering Research Canada	$90,000

UNIVERSITY OF
WINDSOR

Investigating Better Crash Protection for Children

Mechanical engineering Professor Bill Altenhof is focusing his research on protecting the most vulnerable members of society—children. Together with the Auto21 (**Network of Centres of Excellence**) Child Safety Research Program, he is working to analyze what happens to children in crashes.

"It's an area that has received very little study and funding. We don't understand it and we don't research it as well as we do car crashes involving adults," says Dr. Altenhof.

With $20,000 a year in funds, and proposals to triple that amount next year, Dr. Altenhof focuses his study on primarily head and neck injuries. Unlike adults, he explains, about 30 percent of a child's body mass is in the head—necessitating much better protection than is currently used. Why not, for instance, apply the technology found in the head and neck support device used in race cars?

The rearward-facing child safety seat—currently being used by babies less than a year old—is another possible safety device for older children since research shows that children of up to three years of age are susceptible to injury.

Among his other research initiatives, Dr. Altenhof is looking into the design of structural automotive components for crash-worthiness and energy absorption. Here, he sees potential for metallic or plastic braided tubes in vehicles. He is also proposing research into side impacts and, ultimately, rollover accidents with the aim to introduce energy-absorbing materials such as metallic foam to minimize injuries.

Dr. Bill Altenhof is investigating new strategies to protect children in crashes.

funding profile

◗ Science and Engineering Research Canada	$20,000
◗ AUTO21 (Networks of Centres of Excellence)	$20,000

UNIVERSITY OF
WINDSOR

Tracking Windsor's Air Pollution

Windsor has some of the highest levels of air pollution in Canada and Dr. Iris Xu intends to find out where it's coming from and how it affects different parts of the city. The Assistant Professor in the Department of Civil and Environmental Engineering at the University of Windsor is working on major projects to measure and monitor air flows.

Her air quality monitoring project—part of a joint U.S.-Canada Border Air Quality Strategy announced in 2003—looks at the different sources and levels of air pollution. Through her research, Dr. Xu has found that prevailing winds from the west and the nearby states of Michigan, Ohio and Wisconsin as well as Ontario greatly influence air quality.

Dr. Xu's study is divided into three parts. The first involves modelling analysis and transboundary issues. The second part measures levels and sources of air pollution throughout the city. The last part, which Dr. Xu hopes to start soon, is source-specific and will measure pollution on Huron Church Road to determine the concentrated levels that can be attributed to transport truck traffic.

Dr. Xu cautions this information provides a "snapshot" of air quality at a given time. "I don't want people to think that the current situation is forever or to make projections based on the study," she says.

Dr. Xu has also studied mercury levels in the Windsor area. Working with Environment Canada, the U.S. Envi,onmental Protection Agency and its International Joint Commission, she has developed a computer model to predict where mercury will be deposited after its release and how and when it will change forms. Mercury, a heavy metal, becomes hazardous when it changes into a salt form, mixes with rain or dust particles and settles into lakes, rivers and farmland.

Dr. Iris Xu is part of a joint U.S.-Canada investigation into air quality around the Windsor area.

funding profile

Science and Engineering Research Canada	$20,000
Environment Canada	$6,500
Health Canada	$25,000
Canada Foundation for Innovation	$50,000
Ontario Innovation Trust	$50,000

UNIVERSITY OF
WINDSOR

Equity and Access for Diverse Population

Windsor-Essex County is the second-fastest growing community in Ontario, thanks largely to immigration. In fact, its proportion of foreign-born population is ranked fourth in Canada.

Yet resources haven't kept up with this growth. Through her research, University of Windsor Social Work Professor Uzo Anucha aims to advance equity and access for vulnerable groups such as immigrants, refugees and the homeless.

Her research on immigration focuses on race, gender, class, ethnicity and age—the barriers that prohibit full participation into Canadian society.

"Increasing diversity offers opportunities as well as challenges," says Dr. Anucha, co-facilitator of the Applied Social Welfare Research and Evaluation Group. "We need to understand how to give them better access to social, cultural and economic opportunities in Canada. This will enable them to fully engage in Canadian society."

Through her research, Dr. Anucha has discovered that some people within high-risk groups are vulnerable to re-occurring homelessness. She hopes to raise awareness of this issue and develop strategies that will help these individuals avoid the cycle.

At the international level, Dr. Anucha is promoting gender equity in Nigeria by enhancing women's health and well-being, especially as it relates to HIV-AIDS. Here, she notes a powerlessness among women to negotiate safe sex as a result of unequal gender/power relations.

Overall, Dr. Anucha seeks to disseminate information to create a more just, equitable and accessible society and convince policy-makers to implement solutions.

funding profile

Social Sciences and Humanities Research Council	$100,000
Status of Women Canada	$79,000
Joint Centre of Excellence for Research on Immigration and Settlement	$10,000
Canada Housing and Mortgage Corp.	$25,000
Canada Foundation for Innovation	$47,759
Ministry of Economic Development and Trade	$47,759

UNIVERSITY OF
WINDSOR

Plant Compound Shows Promise as Cancer Cell Killer

Dr. Siyaram Pandey, Professor in Biochemistry at the University of Windsor, has discovered an anti-cancer compound that could revolutionize the treatment of cancer. The compound is called pancratistatin (PST) and it kills cancer cells while sparing healthy tissue.

Found in a spider lily plant native to Hawaii, Dr. Pandey predicts that if PST is used in cancer treatment, patients will no longer experience hair loss and a weakened immune system, the common side effects of chemotherapy. "We are excited by this discovery—PST is far less toxic than other treatments and far more effective in killing cancer cells," he explains.

Dr. Pandey has been working for the past two years with a research group comparing the PST compound to other cancer treatment drugs such as Taxol and VP 16. His research collaborators include Dr. Caroline Hamm of the Windsor Regional Cancer Centre, who supplied cancer samples from her patients, and James McNulty, Chemistry Professor at McMaster University, who provided a synthetic version of PST.

They tested PST on 10 different kinds of cancer cells, as well as cells from healthy volunteers. Dr. Pandey expects to have a drug ready for clinical testing on animals within five to six years, depending on funding. He is looking to the National Cancer Institute of Canada and the Canadian Breast Cancer Foundation of Ontario for support during these trials.

Dr. Siyaram Pandey is researching the properties of a new anti-cancer compound.

funding profile

Science and Engineering Research Canada	$100,000
Canada Foundation for Innovation	$416,696
Ontario Innovation Trust	$416,696
Heart and Stroke Foundation	$56,000

UNIVERSITY OF
WINDSOR

Teaching Math to Aboriginal Students

With today's advances in mathematics, science and technology, it is unfortunate that few young people enrol in math and science subjects. The flight from math and science is even more prevalent among aboriginal populations where indigenous students fail to see the relevance of these subjects to their culture, aspirations or way of life. To rectify this situation, many aboriginal scholars and indigenous leaders have stressed the need to re-orient math and science education in aboriginal schools toward developing culturally sensitive curricular materials and teaching strategies.

An expert on cross-cultural issues in math and science education, Dr. Anthony Ezeife in Windsor's Faculty of Education has embarked on a study that will integrate culturally sensitive materials into an existing math curriculum and introduce it to an aboriginal classroom.

To develop his aboriginal math-teaching models, Dr. Ezeife is using phenomena, materials, activities and traditional practices gathered from the Walpole Island First Nation community. These math-teaching units will be incorporated into specific strands of the existing Ontario Grades 1-8 math curriculum to produce an integrated curriculum. The classroom will then be monitored to determine which curriculum strands—either integrated or traditional—have the greater impact on math teaching and learning in an aboriginal setting.

This research will provide both Canadian and international academics with valuable insight into the benefits of teaching math and science within a culturally relevant context.

Dr. Anthony Ezeife is using materials from the Walpole Island First Nation community in his teaching research.

funding profile

- Social Sciences and Humanities Research Council $57,796

UNIVERSITY OF
WINDSOR

Strengthening the Fight Against Violence

Each year, violence against women costs Canadians health-related expenses, social and legal services and lost time from work. Survivors of this violence make up much of the productive and creative work force of Canada. Dr. Charlene Senn is researching women's victimization along with their simultaneous ability to resist, strengthen and heal from this abuse. Dr. Senn's recent award from the Ontario Women's Health Council (OWHC) will assist in her goal.

In the first phase of her research, Dr. Senn will develop and test three theoretical rape-resistance programs. The most effective program will then be expanded and its long-term objectives determined. In the final phase, the expanded program will be distributed to university campuses across Canada to be used as a deterrent against violence.

The OWHC award will also enable Dr. Senn to establish a Health Research Centre for the Study of Violence Against Women. This Centre will act as an intellectual home for many researchers and trainees with interests that include the causes, prevention and rehabilitation of violence against women. The Centre will communicate research ideas and results; serve as a base for an extended mentorship program; and fund junior researchers looking to establish their own independent research studies related to women's health and violence against women.

The OWHC was established by the Minister of Health and Long-Term Care in 1998. It has one objective—to improve the health of Ontario women at all stages of their lives. To achieve this goal, the OWHC provides expert opinion and advice to the minister; advocates on behalf of Ontario women and acts as a catalyst for change in the health care system. Currently, the OWHC is using its mandate to increase the province's research capacity in women's health.

Dr. Charlene Senn is investigating strategies to prevent violence against women.

funding profile

- **Social Sciences and Humanities Research Council Funding (Co-Investigator)** $125,856
- **Ontario Women's Health Council** $300,000

YORK
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Dr. Sergey Krylov's research into new diagnostic technology will impact a variety of incurable diseases.

York Researcher Creates Diagnostic "Swiss Army Knife" to Combat Complex Diseases

Locating cancer cells in human tissue at the early stages of the disease is not unlike locating a needle in a haystack. But by developing new technology to analyze proteins in individual cells, York University's Sergey Krylov has made that haystack much smaller. His hope is to create a diagnostic "swiss army knife" that will diagnose and treat not only cancer but also a variety of incurable diseases, including diabetes, Parkinson's and Alzheimer's.

"Cell proteins regulate everything that goes on in cells," says Dr. Krylov, a **Canada Research Chair** in Bioanalytic Chemistry. "If we can find out how they control cell division, we will have a key to treating many deadly diseases."

But to understand the mechanisms that cause these diseases scientists need to know the biological and chemical properties of individual cells. Conventional methods, however, do not allow researchers to isolate and examine individual cells. In fact, pathologists traditionally have been forced to examine portions of cancerous tissue—large, cumbersome clusters of cells, not unlike haystacks.

Dr. Krylov's revolutionary method, however, will enable pathologists to perform a chemical analysis of each cell in the context of its own environment. In collaboration with Dr. N. J. Dovichi, Dr. Krylov has developed a new bioanalytical technique called chemical cytometry that involves the injection of a single cell into a tiny capillary where the cell's components can be separated and identified using electrophoresis and laser-induced fluorescence detection. Combining this process with different microscopic techniques allows researchers to probe both the chemical and biological properties of a single cell.

Dr. Krylov is using this new research tool to study stem cells, which he believes will ultimately provide a means of treating many deadly diseases. More specifically, he wants to understand why stem cells divide asymmetrically (in effect, producing two new cells, each with different characteristics).

"Unlike stem cells, cancer cells divide symmetrically, creating replicas of each other, and they can do so indefinitely—causing tumours," says Dr. Krylov. "If we could intervene and make the cancer cells divide asymmetrically, the way stem cells do, we would have a new way of treating cancer."

Ultimately, Dr. Krylov wants to learn how to control this division and differentiation of cancer cells. His interdisciplinary research—drawing on the fields of chemistry, biology and physics—is expected to lead to techniques for regenerating tissue in damaged organs. His research project is currently the only substantial one of its kind in the world.

funding profile

Canada Research Chair	$500,000
Science and Engineering Research Canada	$112,600
Canada Foundation for Innovation	$208,159
Ontario Innovation Trust	$208,159
Ontario Cancer Research	$475,000

YORK
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York Researcher Takes on Bullies

Concern over schoolyard bullying among children has been growing across Canada over the last few years, and now York University Professor Debra Pepler is taking on the bullies herself—with help from the federal government.

York's LaMarsh Centre for Research on Violence and Conflict Resolution has received $600,000 from the federal government for a three-year anti-bullying project led by Dr. Pepler. Currently in the second year of that project, Dr. Pepler is working to create a national strategy on bullying to make Canada a safer place for children and youth.

"It is our belief that all children in Canada have the fundamental right to be safe from bullying and harassment in their homes, schools and communities," she says. "A national strategy on bullying would represent an important crime prevention initiative because children who bully are at increased risk for engaging in illegal activities, such as delinquency and substance abuse."

Dr. Pepler has found that the use of power and aggression found in playground bullying is a key component of sexual harassment and dating aggression. In fact, bullying may also lay the foundation for workplace harassment, marital aggression, child abuse and elder abuse. Dr. Pepler's national strategy on bullying would build a broad coalition of national and local organizations supporting grassroots efforts to combat the problem, with leading-edge research on the most effective ways to assess and intervene in bullying situations. The local organizations would include government, the private sector, schools, community groups and individuals.

An expert on children at risk, Dr. Pepler recently discussed social bullying among girls in *It's a Girl's World*, a National Film Board documentary that exposes the hidden culture of girl cliques.

Demonstrating the collaborative nature of York research, the LaMarsh Centre's project combines the expertise of researchers and practitioners in the field of child development at York University, the Toronto Hospital for Sick Children, Queen's University and the University of British Columbia. The project is funded under the federal government's National Crime Prevention Strategy.

In addition to her work on the national bullying strategy, Dr. Pepler was recently named to the Ontario government's new Safety Action Team being spearheaded through the Ministry of Education and the Ministry of Community Safety and Correctional Services. The Ontario government is launching a comprehensive prevention-based plan to deal with known safety issues in Ontario's schools, including bullying, and the special action team of safety experts has been appointed to implement the plan.

Dr. Debra Pepler is working on a national strategy to prevent bullying among children and youth.

funding profile

Canadian Institutes of Health Research	$1.1 million
Department of Justice, Crime Prevention Program	$500,000
Ontario Mental Health Foundation	$101,289

York Researcher Creates Antimatter

Ten kilometres away from Geneva, Switzerland, at the foot of the Jura mountains, sits CERN, the European organization for nuclear research and the world's largest particle physics centre. It is also the place where York University Professor Eric Hessels is making history . . . or anti-history.

Along with his team at York, Dr. Hessels, a **Canada Research Chair** in Atomic Physics, is collaborating with the international Antihydrogen Trap (ATRAP) group at Harvard University on a method to trap so-called antiatoms long enough to conduct experiments. The group recently produced abundant antihydrogen particles in CERN's 27 km-long "atom smasher."

"Antihydrogen is amazingly difficult to create," says Dr. Hessels. "It's a little like having a handful of planets and a handful of suns. You can't just shuffle them together and hope that this amazingly delicate thing happens that the planets start orbiting the suns. You have to somehow get them to start orbiting."

Dr. Hessels recently captured a **Science and Engineering Research Canada (NSERC)** Steacie Memorial Fellowship, one of Canada's top science and engineering honours, for his internationally acclaimed work on antimatter. As part of his **NSERC** Steacie research, Dr. Hessels will be working with the ATRAP team to contain antihydrogen in mid-vacuum using a magnetic field. The team will consequently be able to watch and measure it for hours.

"This is going to tell us whether antimatter is a mirror image of matter and thus how symmetric the universe is," says Dr. Hessels. While most physicists believe that matter and antimatter are identically symmetrical, the measurements of antimatter particles to date aren't yet accurate enough to seal the debate.

Dr. Eric Hessels is focusing his research on antimatter.

funding profile

◗ Canada Research Chair	$1.4 million
◗ Science and Engineering Research Canada	$400,000
—Discovery Grant	$126,000
—Steacie Memorial Fellowship	$90,000
◗ Canada Foundation for Innovation	$280,800
◗ Ontario Innovation Trust	$280,800

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York Researcher Creates Thin Films One Molecule at a Time

Nanotechnology has emerged as one of the great, uncharted frontiers of the 21st century. In the next few years, nanotechnology is expected to dramatically improve manufacturing techniques, enabling industry to make products that are stronger, lighter, cleaner and cheaper. Working on an incredibly tiny scale (one nanometre being a millionth of a metre) scientists will be able to snap together molecules—the basic building blocks of nature—in a way that is simple and inexpensive.

York University's Dr. Sylvie Morin is one such scientist. A Professor of Chemistry and **Canada Research Chair** in Surface and Interfacial Electrochemistry, Dr. Morin is researching new ways to develop and diversify the applications of nanotechnology.

Using scanning spectroscopy, Dr. Morin is studying metal ions at the atomic and nanometric scale. Her research aims to show how these ions, suspended in a liquid solution, can be used to create a film so thin that it measures only a few nanometres in thickness and is virtually two dimensional.

"A better understanding of these films," says Dr. Morin, "may ultimately contribute to the growth of nanotechnology, particularly in areas such as nanoelectronics."

Her work on thin films also has important applications for cancer diagnosis. In collaboration with Dr. Michael Siu, Director of York's Centre for Research in Mass Spectrometry, Dr. Morin is designing thin organic surfaces that can selectively bind biological molecules, including protein markers that may aid the diagnosis and prognosis of diseases such as cancer.

"These cancer markers can be really difficult to bind and identify," explains Dr. Morin. As a result, there are currently few clinically useful cancer markers. Ideally, researchers could place cell material on a thin organic surface and, after rinsing it with the appropriate solution, analyze the cell's proteins.

"By understanding how these films can be produced and understanding the interactions with the proteins," says Dr. Morin, "we can design better surfaces. And that means better, faster and more accurate diagnosis for cancer patients."

▼ Dr. Sylvie Morin's research into nanotechnology will one day help manufacturers make better products and doctors make more accurate cancer diagnoses.

funding profile

◗ Canada Research Chair	$500,000
◗ Science and Engineering Research Canada	$160,800
◗ Premier's Research Excellence Award*	$150,000

* Two-thirds of each PREA is funded by the province and one-third is provided by the university.

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Bringing Life to Theory

While functional magnetic resonance imaging (fMRI) scans allow doctors to directly observe and assess the brain functionality of their patients, the accuracy of fMRI studies can sometimes be low. For example, a patient's movements—even breathing—can complicate a signal, making it difficult for doctors to detect brain activities. York University's Dr. Hongmei Zhu, however, is working to correct all of that. An Assistant Professor in the Department of Mathematics and Statistics, Dr. Zhu is applying her mathematical research on analyzing wave patterns or frequencies to human health—with startling results.

"When patients move during an fMRI scan," says Dr. Zhu, "the scan's signal can become degraded, complex and hard to read." Dr. Zhu's innovative research brings clarity to the component parts of a signal, enabling researchers to improve signal quality by identifying and removing undesired frequency components. This leads to better diagnosis as well as more precise treatment assessments.

"We can also produce a texture map of the human brain from patients' scans," says Dr. Zhu. "This may help doctors detect multiple sclerosis at its very early stage, and then follow the disease's progress through time."

Since joining York last year, Dr. Zhu has continued to refine her technology—first developed with an interdisciplinary team of medical physicists, neurologists, computer scientists and mathematicians at the University of Calgary's Seaman Family MR Research Centre. Dr. Zhu's research is related to the work of Joseph Fourier, a mathematician who developed the Fourier Transform in 1804, a tool to help study frequencies and waves. Since then, the tool has been further refined into a class of time-frequency analysis techniques, which reveal signal frequency content over time and/or space. One technique, the Stockwell-transform, was first developed in 1996 by researchers at the University of Western Ontario. But Dr. Zhu is the first to apply it to MRI.

"Theory, of course, is immensely important," says Dr. Zhu, "but application brings life to the theory."

Dr. Zhu's innovative mathematical work has seemingly endless applications, especially in areas such as culture and entertainment. Her research, for example, will enable researchers to break down a piece of digital music into its component sound waves, and determine when different notes or instruments come into play. It also has the potential to improve music quality by reducing noise and removing undesirable sounds, and can be used to improve digital photo quality. Dr. Zhu's interdisciplinary research even has applications to disciplines as diverse as finance and remote sensing.

Dr. Hongmei Zhu is applying her research in mathematics to improving MRI accuracy.

funding profile

Science and Engineering Research Canada	$14,000

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York U: the New Hub for Business Ethics Research in Canada?

Over the last several years, corporate scandals have dominated the news, drawing the practices of many corporations into sharp focus, and creating an urgent need for research into how businesses conduct themselves on the global stage.

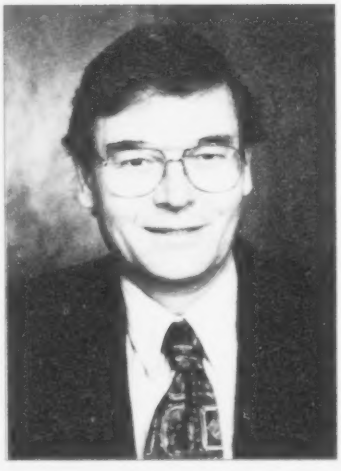
Rising to meet this challenge, York University may soon be the hub for interdisciplinary business ethics research in Canada. Dr. Wes Cragg, Gardiner Professor of Business Ethics at the Schulich School of Business, is developing a business ethics research network that promises to draw the business community into close dialogue with academics, NGOs and government, fostering a synergistic research environment.

"This network will be the first of its kind in Canada," says Dr. Cragg. "It will provide a vital centre for scholarly research, and it will also contribute greatly to the growing debate about the ethical responsibilities of corporations."

Dr. Cragg, an expert on business ethics, recently completed a major interdisciplinary project that explores the effectiveness of ethics codes in regulating business practice on an international level. The resulting book, *Ethics Codes, Corporations and the Challenge of Globalization*, edited by Dr. Cragg, draws together the insights of a number of diverse scholars, many with differing perspectives on how to regulate corporate behavior. But while some argue that corporations won't behave without an international body of law to watch over them, Dr. Cragg's own findings suggest differently.

"Corporations that allow independent outside monitors to scrutinize their actions tend to abide by ethics codes," says Dr. Cragg. "As long as corporate monitors are independent and able to publish their results, corporate self-regulation seems to work."

Dr. Cragg's book, just released, was supported and copy-edited by York graduate students over a period of six years. The research project entitled Ethics Codes: The regulatory norms of a globalized society? also brought together two national round tables of experts from different sectors of society, and has already had a policy impact, laying the foundation for Dr. Cragg's interdisciplinary research network.



▼ Dr. Wes Cragg's research explores ethics and corporate behaviour.

funding profile

- Social Sciences and Humanities Research Council
  - —Strategic Research Grant $249,922
  - —INE Grant $16,000
  - —Strategic Research Cluster Grant $30,000

Published June 2005

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